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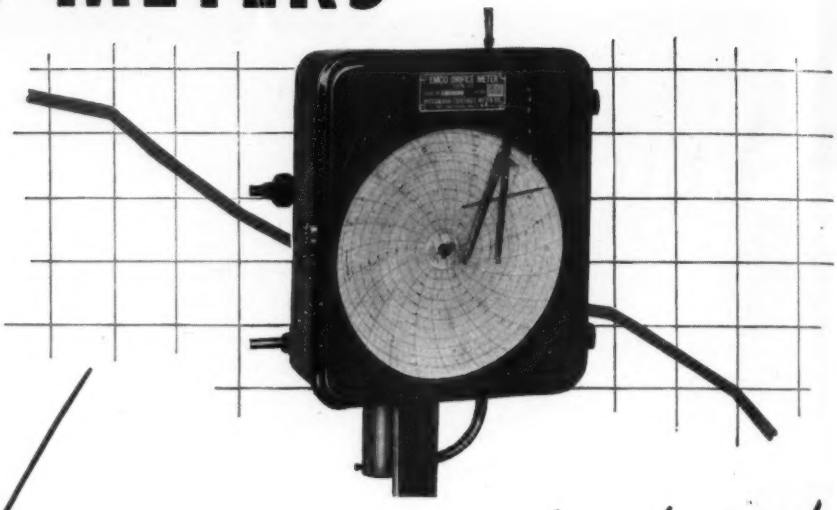

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published weekly by the

PETROLEUM PUBLISHING COMPANY

211 S. CHEYENNE AVE., TULSA 1, OKLAHOMA

FOUNDED IN 1910 BY PATRICK C. BOYLE

Subscription rate to the petroleum industry, United States and foreign, 1 year, $3.00. Single copies, 20 cents. Back copies, when over a year old, 50 cents. Note: Payments from outside the U.S.A. may be in the form of an international money order or check on a U.S.A. bank. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879.

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Associated Business Papers

Vol. 46, No. 38 January 22, 1948

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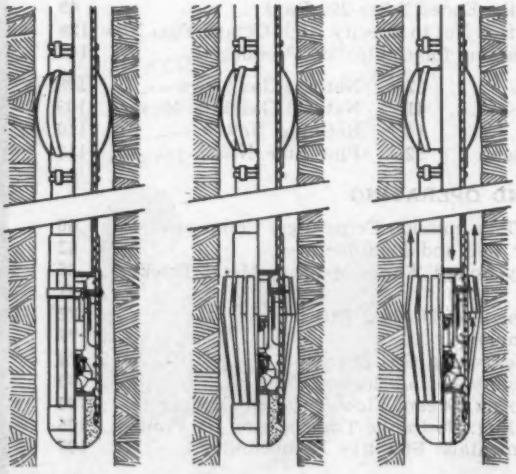
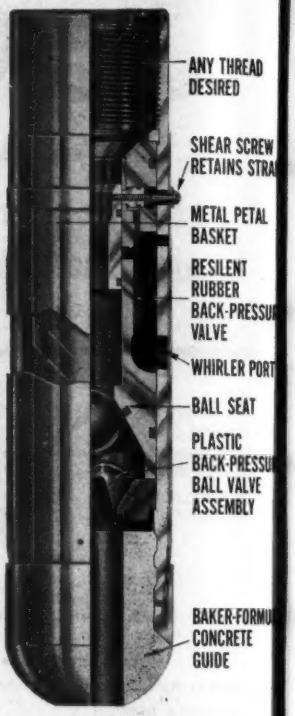
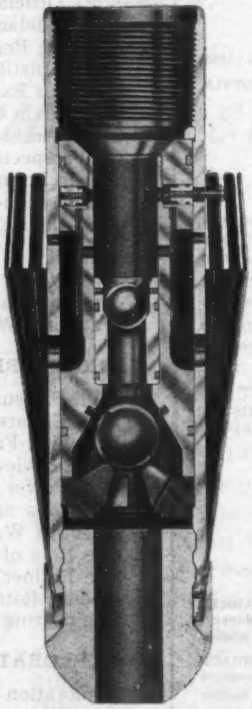


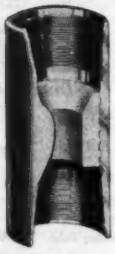
The Baker Triplex Cementing Shoe (left) in running-in position, centered in the hole by a Baker Casing Centralizer. In the center illustration the Tripping Ball has been dropped, seated, and the Tripping Valve forced downward. This action shears the shear screw holding the Metal Petal Basket against the Shoe, and permits the Metal Petal Basket to expand against the side walls of the hole. The ports are now open ready for cementing. At right, cementing is under way, with the slurry directed upward to completely encase the centered pipe with a uniformly thick body of cement with the expanded Basket retaining the cement above the Shoe.

The Baker Triplex Flapper Valve Float Collar (Product No. 134) may be run in place of the Triplex Baffle Collar when an additional float valve is desired. Note how it is designed to permit passage of the Tripping Ball, and how an ample flat surface is provided for "bumping" the cementing plug.

At right the Triplex Shoe is shown in running-in position, with the Metal Petal Basket held against the Shoe by the hold-down strap which is fastened by a shear screw.



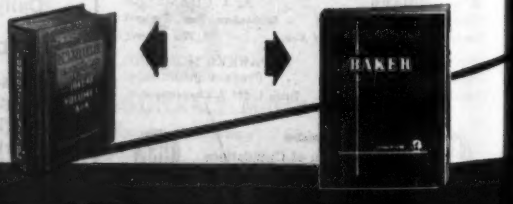




The Triplex Cement Baffle Collar (Produc No. 137) is run a joint or two above the Sho and serves as a stop for the cementing plug so that mud-contaminated cement is retaine inside of the casing. The hole is bevelled at it top to permit easy passage of the Tripping Ball

(Left) The Tripping Ball has been dropped an seated on top of the Tripping Valve. Pressure a about 500 psi has sheared the shear screws an forced the Tripping Valve down to expose the ce menting ports. Shearing the screws also permit the Metal Petal Basket to expand against the sid walls and form a bridge which holds the cemen slurry *above* the Triplex Shoe and protect permeable, low-pressure zones below from cemen contamination.

Complete details are in the 1948 Baker Catalog — and THE COMPOSITE CATALOG



BAKER TRIPLEX CEMENTING EQUIPMENT

THE OIL AND GAS JOURNAL

125 Per Cent Capacity

A PRODUCTION reader asks how a group of refiners can operate their plants 25 per cent in excess of rated capacity. He had reference to the weekly A.P.I. refinery report for the week ended January 3 which revealed that crude runs to stills of important refining areas were 5 to 25 per cent greater than total capacities, with the refining industry in this country as a unit operating practically 100 per cent capacity.

These record operations reflect the all-out efforts of the owners of approximately 375 refineries in this country to supply the winter demands for petroleum products. A similar situation exists in refineries outside this country. The rated capacity of a refinery has been defined as its daily crude-oil throughput with the most efficient utilization of its processing facilities. Prewar this meant an operation in which the maximum yields of the most essential and most valuable products of a barrel of crude oil were obtained. The objective of most plant operators was greater yields of gasoline through the expansion of cracking facilities.

The rapidly increasing demands for furnace oils and burning oils since the close of the war have changed this normal trend at many plants. To increase the output of these intermediate products more emphasis has been placed on maximum throughput of crude oil and less on balanced operations. In some plants units formerly utilized for other services have been converted to crude distillation. In other situations the output cracking installations which operate with the intermediate products as charging stocks are being curtailed and gasoline yields sacrificed.

By way of comparison the record crude runs to stills of 5,637,000 bbl. daily at domestic refineries for the week ended January 2 were 16 per cent greater than the corresponding week of the previous year and 45 per cent greater than the average operations of 1941. Should any serious shortages of oil fuel materialize over the next 90 days it will not be because refiners failed to use every operating facility available.

But operations in excess of efficient capacity obviously are a makeshift arrangement which cannot be continued indefinitely. That is why refiners as a group are now engaged in the greatest expansion and modernization program in their peacetime history. Market conditions which permit profitable operation despite the lack of up-to-date equipment are temporary.

The war requirements and subsequent developments have given operators a technology which represents important advances in practically every phase of refinery operation. Normalcy will have returned in refining when owners have had the time and equipment to expand their operations to take full advantage of new techniques and when operating levels are again within the rated capacities.

Long-Range Military Oil Plans Given Congress by Forrestal

by Bertram F. Linz

WASHINGTON. — Oil requirements of the next war will be 2,000,000 bbl. a day more than the "foreseeable" domestic production, and an $8,000,000,000 capital investment would be required to produce that amount of synthetic liquid fuel to fill the gap, Defense Secretary James Forrestal told a House armed services subcommittee January 19.

Testifying as the first witness at hearings on the petroleum situation which will run through the next 6 weeks, Forrestal said military experts do not anticipate that any new fuel will replace oil in the near future, and the latter will be even more important in the next war than it was in the latest.

Forrestal also told the subcommittee:

Development of Alaskan oil resources should be pushed, and continued government support should be given the exploratory program in Naval Petroleum Reserve No. 4.

The Alaskan reserve and No. 1 in California are the only reserves worth retaining, and negotiations for the return of the others to the Interior Department are now under way.

Legislation for administration of the California tidelands is now being readied for submission to Congress within the next 60 days.

Imports should be stepped up to provide supplies and conserve our own resources, but not to the extent of discouraging or depressing domestic exploration and development.

Russian Information Lacking

There is no dependable information available regarding Russian resources, but while Russia may achieve some skill in development techniques it is not believed a development comparable to our own can be achieved under bureaucratic direction.

Forrestal disclosed that the Army-Navy Petroleum Board and the Petroleum Purchasing Agency are being reconstituted as joint organizations of the Army, Navy and Air Forces in line with the policy of unification contemplated under the National Security Act of 1947. The purchasing agency will provide a single point of contact between the petroleum industry and the military departments, an objective which he said the industry has been anxious to have accomplished.

Taking the position that "undeveloped oil fields provide no power for the machines of either war or peace," Forrestal said the military establishment believes that development of the tidelands areas should proceed as rapidly as possible and that all necessary action should be taken to permit rapid development of those areas.

He refused to be drawn into a discussion of the tidelands situation, however, and in response to a question from Rep. Overton Brooks of Louisiana as to whether the states should cease development of underwater resources said he had come to no conclusion. He said also he would not recommend "national conservation," but felt the states and the industry already were making great strides in preventing waste. But, he said at another point, unless new resources are developed the country will have to return to the four-cylinder car instead of six or eight cylinders, in 10 years.

Middle East Import

Forrestal told the subcommittee the Navy now is importing considerable oil from the Middle East, where it pays $1.05 a barrel for Navy special fuel as against something like $2.12 on the Mexican Gulf. Production in the Middle East, now around 750,000 bbl. a day, is to be doubled by 1951, he said, but company plans do not provide for bringing a proportionate share of the increase to this country.

He agreed with Subcommittee Chairman Dewey Short of Missouri that the situation in the Middle East is "disturbing" and it would be unwise to figure too much on that area now if an emergency developed.

The secretary indicated definitely that the military believe the United States can attain self-sufficiency in oil only through the development of a synthetic industry. The discussion, however, developed that it would take not only large amounts of capital, but also great volumes of steel, and manpower which could not be spared in time of war.

To get the know-how and technical information which would speed up development of the industry, he suggested, the Government should extend its present research program to the building of a few large-scale plants, possibly in cooperation with industry. Germany produced synthetic oil during the war at a cost of around $2.25 per barrel, but that figure did not include capital investment or other fixed charges, and work should be undertaken in this country to develop the practicability and usability of synthetics.

"Most members of this committee think we have been tardy and are far too late in the development of synthetic fuel," Short commented.

The subcommittee also received an outline of the situation and outlook from Director Max W. Ball, of the Oil and Gas Division, and later this week will hear Eugene Holman, president of Standard Oil Co. (N.J.), or Howard W. Page, his assistant, and Walter S. Hallanan, chairman of the National Petroleum Council. Next week it will call a number of government officials.

The schedule of hearings calls for presentation of testimony not only on present and long-range needs of the military services but also on the petroleum reserves in Alaska and California and the development of synthetic fuels.

Military Oil Demands Cut But Still Unmet

WASHINGTON. — Military petroleum requirements for the 6 months ending June 30, next, have been cut back 8,000,000 bbl., it was disclosed January 20 in a report of the National Petroleum Council committee on military and government petroleum requirements released by Council Chairman Walter S. Hallanan.

With cutbacks made in requirements for the last 6 months of 1947, total needs of the services for the current year will be 106,767,000 bbl. instead of 117,522,000 bbl. previously estimated, Acting Committee Chairman Howard W. Page reported, and the requirements for the January-June period will be 2,103,000 bbl. less than actual purchases in the last half of 1947.

A statistical table appended to the report showed that the military have received offers 13.4 per cent more than requirements for motor gasoline, but are still from 4 to 57 per cent short of filling requirements for other products. So far, offers received will provide 84.5 per cent of the aviation gasoline sought, 96.1 per cent of kerosine, 80.7 per cent of Navy diesel, 95.4 per cent of other diesel and burner, 73.8 per cent of Navy special fuel oil, and 43.3 per cent of other heavy fuel oil.

Total requirements for all of fiscal 1948 now are set at 21,092,000 bbl. of aviation gasoline, 14,650,000 motor gasoline, 1,203,000 kerosine, 15,942,000 Navy diesel, 2,023,000 other diesel and burner, 40,294,000 Navy special fuel oil, and 11,563,000 other heavy fuel oil. The current figures, Page reported, are understood to take into account the over or short position on actual deliveries versus estimated requirements for the July-December 1947 period.

Oil Rationing and Price Control Authority Needed Now, Krug Says

WASHINGTON.—Interior Secretary J. A. Krug last week told the Senate foreign relations committee that the fuel situation in this country complicates the problem of meeting the essential oil needs in the European recovery program, and the following day told the Senate banking and currency committee that if President Truman's request for control authority is granted he will immediately freeze the prices of fuel oil and gasoline.

In testimony before both committees, Krug indicated the possibilities of oil rationing, and before the foreign relations group he revealed concern over the possibilities of interruption of oil supplies from the Middle East during the period of the recovery program.

So far as ERP shipments are concerned, he said, "the United States will not send abroad one drop of oil or oil products that will not be more than offset by imports of petroleum."

But, he admitted under questioning by Chairman Arthur H. Vandenberg of Michigan, if Middle East oil is not available, the amount shipped by the United States will have to be increased, in which event rationing would become necessary.

He agreed with Vandenberg that if Middle East oil were cut off by a possible war it would have serious consequences for the entire European economy, but contended that only a war situation could stop the flow of oil from that area.

Under ERP, Krug said, a burden will be imposed on our already overtaxed oil facilities and "intelligent and intensive conservation programs" will have to be adopted.

Synthetic Development Urged

Because of the critical oil situation at home and abroad, Krug urged that the program for development of synthetic liquid fuels be stepped up to "avoid a future dependence upon an insecure source of supply from distant lands."

Before the banking and currency committee, Krug, as had Secretary of Commerce W. Averell Harriman just before him, killed the President's argument that he wanted control authority for use in the event of a possible emergency, rather than for immediate application. Both cabinet members indicated their belief that the emergency is upon us and stated an intention of imposing controls immediately, if authority is granted.

As outlined by Krug, the latest administration plan would call for a 60-day "freeze" of petroleum products all along the line, as authorized by a bill introduced by Sen. Alben K. Barkley of Kentucky, and during the freeze period consultations would be held with the industry to arrive at maximum price ceilings. Under the bill, he said, Congress would then have a 30-day period in which to reject, by concurrent resolution, any pricing program developed for any industry.

Because of lack of information, Krug told the committee, he could not say now whether oil prices would be rolled back or frozen at present levels, and that decision would be made during the freeze period.

Reviewing the current situation, the secretary emphasized the country is not running out of oil, but warned that shortages would continue until new production and refining capacity gets the industry back on an even keel. Steel alone will not overcome the shortage, he contended.

Krug also urged the granting of the allocation and rationing authority asked by the President. Both he and Harriman emphasized that only the Barkley bill, which carries out the President's recommendations as he put them before Congress, would be satisfactory and that the Capehart bill is too broad and the Taylor bill too impracticable to be acceptable.

Senate Report on Oil Shortage Flays Both Government and Industry Men

WASHINGTON.—Sen. Kenneth S. Wherry of Nebraska gave the Senate a verbal report of the activities of his small business oil subcommittee January 16.

It was a scathing denunciation of practically every government agency having anything to do with oil—the military services for supporting the export of pipe to Saudi Arabia, the Maritime Commission for selling tankers foreign when they are needed in this country, and the Interior Department for failing to take action to head off the fuel-oil emergency.

Wherry's first swing was directed at the heads of the agencies which participated in the decision to approve 480,000 tons of steel for the Saudi Arabian pipe line.

"The subcommittee has proved to its satisfaction in subsequent open hearings that either these high officials of our Government were misled in information presented to them," he declared, "or there is something afoot in our policy-making branch of government that is neither healthy nor in the best interests of our national welfare."

Decision at Cabinet Level

"It is interesting to note here," he said later in his report, "that the secretary of commerce, who has the last word in deciding upon an export license, made his decision at the cabinet level and not upon the advice of his own Office of International Trade. That office had the courage to tell him that the shipment of 480,000 tons of steel, or any portion of that per quarter, could not be justified with regard to the domestic economy. Other government agencies: The Housing and Home Finance Agency and the Office of Defense Transportation also refused to go along with the Department of Commerce's action.

"Their objections were of little avail."

Turning to the tanker situation, Wherry said the Maritime Commission had not been asked for advice on the Saudi Arabian deal and when the subcommittee began to investigate it found that "counter to the claim that we must build a pipe line for Middle East oil because of a tanker shortage, valuable tankers have been sold to foreign nations" who, he pointed out, could not use the vessels coastwise in this country and might or might not transport oil to American ports.

"The ridiculousness of the situation is that the oil subcommittee has found that the building of a Middle East pipe line does not mean increased supplies of oil, simply improved transportation," he commented. "Furthermore, the pipe line cannot be built for 3 years and in that time the oil must still be shipped by the same number of tankers that have been required right along. A pipe line built with that steel in this country could be put into active use carrying oil to homes and to industry.

"Our world-minded government officials give little consideration to the critical and immediate shortages in our own country, but must rush headlong to benefit every foreign nation on the globe."

Wherry threw his final shot at In-

terior Secretary Krug. Pointing out that Krug only this month "indicated a need for 'action' in the field of distribution of petroleum and its products," the senator asserted "in subsequent releases, Secretary Krug has stated that a return to wartime controls over petroleum are necessary. He also believes in closing the door after the horse is out of the barn."

The senator, however, was equally critical of some phases of the industry's effort, particularly the suggestion for a "hardship pool" from which major companies would supply needy cases, which he said would distribute the oil exclusively through major company outlets, "a phase of the oil shortage which the Senate small business committee has been fighting and will continue to fight."

On the other hand, he said, the industry has made great strides in increasing oil supplies in the face of a lack of materials.

Government Negligence Charged

"We are in the midst of a heating oil crisis today, because government agencies have not taken precautions to safeguard our domestic supplies, our transportation facilities, or provide the means for the development of new oil resources," Wherry wound up.

"We have ample sources of crude oil in this country to supply all of our needs.

"The stumbling blocks and limitations in production and distribution of petroleum products are the problems which must be overcome.

"We must make sure the inordinately large exports of oil to Canada or any other foreign country are reduced to normal.

"We must watch that foreign-aid oil needs are kept at a minimum and that they are satisfied from sources of oil outside this hemisphere.

"We must be alert that foreign-aid needs are not disguised under the heading of military requirements.

"We must insist that shipments of steel pipe and tubular goods in export be granted only after domestic needs for these products have been reasonably satisfied.

"We must see that United States tankers are retained for domestic transportation.

"We must assure that tank-car facilities are used efficiently and that exports of steel are restricted to permit sufficient new tank and freight cars to be constructed.

"We must reveal and correct the monopolistic practices in the oil industry which are smothering independent business and affecting the flow of petroleum products from originating fields, and through the various stages of distribution until its delivery to the customer.

"We don't need controls—we need common sense—and concern over our national problems."

State Officials See No Need for Control Measures for Emergency

WASHINGTON.—Confidence that the oil industry is doing everything possible to alleviate the fuel shortage was voiced by many of the emergency fuel coordinators from a score of states who met with Director Max W. Ball of the Oil and Gas Division January 15 to exchange experiences in the handling of hardship cases.

Although there were expectations that some of the state officials would call for a government coordinator to solve the problem, no such demand was made and there were indications that they believed the industry, the OGD and the National Petroleum Council would work out all possible steps that could be taken.

Representative of various government agencies having an interest in the subject and men from a number of oil companies and oil associations, including the NPC attended the informal conference, which was called by Ball at the instigation of Sen. Charles W. Tobey of New Hampshire.

None of the oil men found it necessary to participate in the proceedings to defend the industry, and some of the coordinators who spoke not only thought the industry was doing all it could but suggested that it should explain present high prices, pointing out the people would understand the necessity for increases if they were told of the added costs necessary to get products to them by expensive emergency mthods.

So far as Government action was concerned, the coordinators contented themselves generally with recommending that conversions be stopped and that reconversions from oil to coal be speeded up. Mostly, they took the position that hardships must be handled on a local level rather than a state basis, and that the state and federal governments should help, but not ration, the oil industry.

Shortage May Last 3 Years

In a talk explaining the situation and the industry's efforts to cope with it, Ball warned the coordinators that winter fuel-oil and summer gasoline shortages might prevail for as much as 3 years. With Undersecretary of the Interior Oscar Chapman, he explained that "no miracles of supply" can be expected and the situation can be corrected only as the industry gets the materials and has the time and money with which to develop and build.

Ball gave the state officials a new approach to the problem, summing it up with the statement that "basically, the trouble is equipment to consume petroleum products can be made and put into operation very much faster than equipment to produce petroleum products."

He said frankly that if present conditions were merely temporary it might be advisable to open up producing fields beyond their MER, even at the risk of some damage to their reserves, but since it is a long-range problem to do so this year would mean merely relief now at the expense of a possible greater shortage next winter.

Ball outlined what the industry is doing to increase both production and refining, pointing out the anomaly of an industry spending large sums of money in the effort to induce people to buy less of its products, and said the Government, too, is doing what it can by encouraging imports by the lowering of tariffs, discouraging exports, and getting tankers back into operation.

NEXT WEEK—THE ANNUAL NUMBER

The January 29 issue of the Journal will be the annual Review and Forecast number. In a special 80-page section will be presented facts and data on the entire industry for 1947, and projections for 1948. Many of the data are based on surveys conducted by the Journal, and they are interpreted with a view to providing the reader something tangible on which to base operations for the coming 12 months. As predicted last year, many records were broken during 1947, and 1948 will see those new records broken in turn.

This will be an issue which will be useful throughout the year, providing as it does a handy reference for day-to-day perusal. This 1948 Review and Forecast issue will be, as it always has been, the industry's most complete and reliable statistical guide.

this week

TRENDS—Crude-oil production during week ended January 17 sets new all-time record of 5,341,135 bbl. daily. . . . An increase of 11,990 bbl. over previous week. . . . Kansas accounts for largest share of net gain. . . . ¶Refinery runs to stills for week ended January 10 average 5,289,000 bbl. daily. . . . A drop of 348,000 bbl. daily from the all-time high of the previous week. . . . ¶Well completions during week ended January 17 totaled 739 as compared to the 671 of the preceding week. . . . Wildcat completions total 136, an increase of 21. . . .

REFINING—Strike at Pure Oil Co.'s Toledo plant ended after 296 days. . . . ¶Stone & Webster buys E. B. Badger & Sons, refinery-engineering firm. . . . ¶Auto designers told not to plan on quantity use of high-octane fuel. . . . W. M. Holaday of Socony-Vacuum tells S.A.E. high octane wastes valuable petroleum ingredients and requires excessive refinery investments. . . . ¶Texas refinery statistics show fuel-oil yield in 1947 low. . . . Products from natural gas up during the year. . . . ¶Continental Oil Co. acquires Ponca City 100-octane plant. . . . Will modernize it immediately. . . . Also expands Denver refinery and buys site for possible refinery in Corpus Christi. . . .

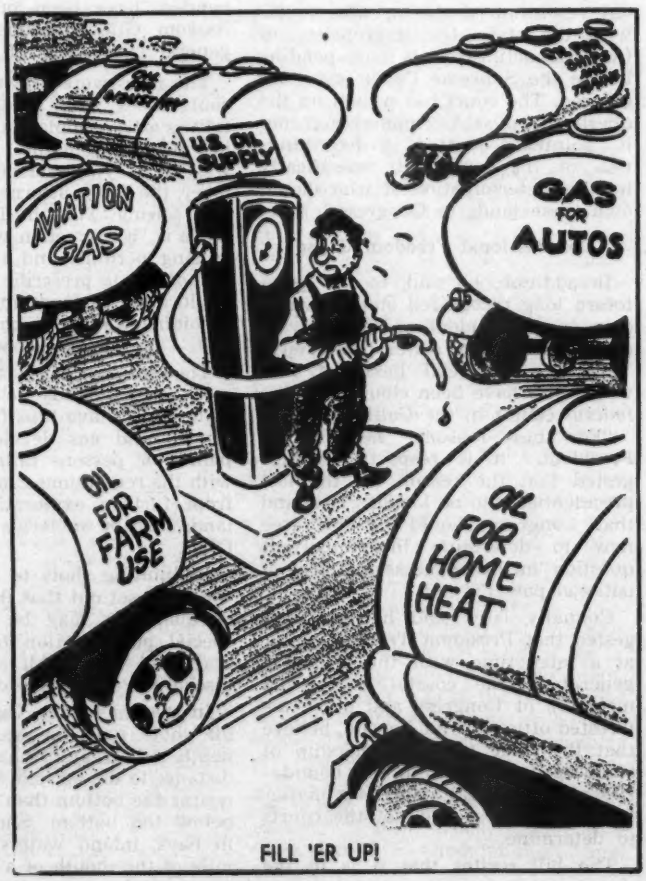
PIPE LINE—Triangle Co. completing common-carrier products line connecting Carthage, Shreveport, and El Dorado. . . . ¶East Tennessee Natural Gas Co. plans 398-mile, $11,500,000 network in Knoxville-Chattanooga area. . . . ¶Panhandle Eastern schedules 712 miles of looping. . . . ¶Utah Oil Refining Co. drops plans for crude line from Rangely field. . . . Texas Eastern reports success with new-type high-pressure centrifugal compressors for gas transmission. . . .

INTERNATIONAL—Occupation authorities plan extensive exploration program in U. S.-British zone of Germany. . . . Seismograph equipment ordered. . . . Hope to find crude for bizonal needs. . . . ¶Trans-Arabian Pipe Line Co. plans to resume work on western end of its project within 2 months. . . . Work had been halted because of political disturbances and violence. . . . ¶Export quotas for petroleum products set by countries for first quarter 1948. . . . Large total of exports brings protests from Congress. . . . ¶Active bidding seen for Venezuelan royalty oil. . . .

TIDELANDS—Legislation disclaiming federal control drafted by state attorneys general. . . . Gains wide support in Congress. . . . President Truman asked not to oppose. . . . Hearings open February 23. . . . ¶Texas promulgates regulations for using explosives in underwater exploration. . . .

CONTROLS—Federal officials seen still seeking power to control oil, steel, other basic commodities. . . . ¶Secretary Krug tells Congress oil rationing and price control needed now. . . . ¶State oil coordinators, in Washington meeting, fail to ask for more governmental powers. . . . Believe voluntary plans will suffice. . . . ¶Senate report blames oil shortage on bungling by both industry and government officials. . . . ¶National Petroleum Council meets this week to plan voluntary oil allocations. . . . Marshall plan requirements a factor. . . .

GOVERNMENT—Long-range military oil plans given Congress. . . . Include synthetic-fuel projects, development of tidelands and Alaska. . . . Imports favored. . . . ¶Permanent program for synthetic-rubber industry framed in new legislation. . . . Would require use of 225,000 tons annually. . . . ¶Oil spokesman opposes change in wage-hour regulations. . . . ¶Congress continues series of oil investigations. . . . ¶Navy's plan to extend Elk Hills reserve meets strong opposition from California oil producers. . . .



FILL 'ER UP!

Evidence that the petroleum industry's public-relations campaign is bringing results in explaining the real cause of a threatened oil shortage is this cartoon in the January 8 issue of the Des Moines Tribune which tells the story at a glance —customers coming faster than the industry can "fill 'er up"

New Tidelands Bill Endorsed by Senators and State Officials

WASHINGTON.—Chances for enactment of legislation clearing up affirmatively all question of the states' ownership of their tidelands are believed now to be better than at any time since the issue first was raised by the Government.

Visiting the White House with Texas Atty. Gen. Price Daniel January 15, Sen. Tom Connally of Texas urged that the President withhold his decision on legislation relinquishing federal claims to the tidelands until legislation now in process of formation reaches him.

The following day, 18 senators joined in introducing a message to give to the states the ownership of resources under navigable waters within their boundaries, including their tidelands, which had the support of the nation's Association of Attorneys General and the Council of State Governments.

At the White House, Connally left for the President a memorandum, in which he pointed out that the argument on which he vetoed the original resolution declaring title to lie with the state—the impropriety of Congress acting on an issue pending before the Supreme Court—now has expired. The court has passed on the question, he said, emphasizing that it "pointedly omitted" a determination of the land and "specifically left the determination of who should own these lands to Congress."

Congressional Freedom Urged

In addition, he said, to the heretofore long recognized states ownership as an incident of state sovereignty, some of the states, particularly Texas, have special bases of title which also have been clouded by the federal claims in the California case.

"For these reasons," he told the President, "it is respectfully suggested that the reason for the last presidential veto no longer exists and that Congress should be left free now to determine the important question 'in this congressional area of national power'."

Connally later said he had suggested that President Truman confer at a later time with the attorneys general of the coastal states and members of Congress and other interested officials who, he said, believe that the issue of the ownership of submerged land within the boundaries of the several states is a matter for the Congress and not the courts to determine.

The bill recites that it is in the public interest that ownership of the submerged lands and the resources therein and the right and power to control, develop, and use those resources shall lie with the respective states or the persons lawfully entitled thereto under the laws of the states, and the United States releases and relinquishes to such states and persons all right, title and interest it may have in the lands.

The tideland area of the states is defined as running to the 3-mile limit of the boundary line of any state which extends into the sea, Great Lakes, or Gulf of Mexico beyond 3 geographical miles.

The bill excepts land and resources or improvements which have been lawfully acquired by the United States or have been held by state courts to be federal property, and also provides, in addition to recognizing the federal Government's rights to control the waters for the purpose of commerce, navigation, national defense, and international affairs, that the United States "shall have the right and power when necessary for national defense, to exercise the preference right to purchase the said natural resources or to acquire and use any portion of said lands by proceeding in accordance with the due process of law and paying just compensation."

Shooting Regulations for Gulf Waters Promulgated by Texas Land Office

AUSTIN.—A set of regulations governing seismic exploration in the Gulf of Mexico off Texas which limit the size of the shot to 50 lb. and require shots in gulf waters to be suspended, have been promulgated by Bascom Giles, commissioner of the general land office of Texas.

The rules were drawn up following conferences with industry representatives after complaints from the fishing industry that the explosives used were destroying marine life. Last October, the Texas attorney-general held that seismic work in Texas' offshore lands is "construction work," thus requiring permits, and that Giles was authorized to prescribe rules for such exploration in lands in the Gulf and adjoining waters which belong to the state's permanent school fund.

The rules applied to exploration work on all lands belonging to the state which have thus far been leased for oil and gas development. Companies or persons failing to comply with the regulations can be prohibited from further exploration on public lands, except on terms stipulated by Giles.

In limiting shots to 50 lb. or less, the rules set out that the use of larger quantities may be permitted on special authorization from the general land office. All shots must be discharged during the daylight hours.

In waters of the Gulf of Mexico, all shots must be suspended at a depth not greater than one-half the distance to the bottom, and in no case, nearer the bottom than 5 ft. or buried below the bottom. Shots discharged in bays, inland waters, or within 1 mile of the mouth of a river shall be buried below the bottom through pipes, the rules specify. Buried shots must be at least 10 ft. below the bottom and at a sufficient depth to avoid a crater.

"Each shot must be discharged before the party placing the pipe leaves same," the regulations provide. "After the shots are fired all pipes left will be immediately removed either completely or so that the top of the pipe will be at least 3 ft. below the bottom of the bay. All pipes, buoys, and all other markers used in connection with the seismic work shall be distinctly marked giving the name of the party using same, and all buoys and other markers shall be anchored by sash weights or similar weights which cannot cause injury to the nets of commercial fishermen. All shots which fail to discharge and all equipment not destroyed shall be immediately removed from the water where the shots are attempted to be discharged.

"Before any shot is discharged in either the Gulf of Mexico or the bays, the exploration party shall employ methods approved by the commissioner of the general land office to frighten or drive away the fish and/or marine life which may be in the area. . . . If there is a school of fish in the area to be shot, operations must be suspended in that particular area until said school of fish have been driven away."

The regulations declare that companies conducting drilling operations in bays or the gulf shall prevent as far as practicable the pollution of the water and interfere as little as possible with the fishing and shrimping industries.

Texas' Distillate Yield Down; Gas Products Up, 1947 Survey Shows

AUSTIN.—Gains of nearly 2 per cent in 1947 runs to stills of Texas refineries and of more than 9 per cent in the production of liquid hydrocarbons from gas are shown in year-end statistics of the Texas Railroad Commission.

A comparison of 1947 with 1946 operations in Texas petroleum processing plants was made in a memorandum report prepared by Jack K. Baumel, chief engineer of the commission, to Col. E. O. Thompson, chairman. Baumel estimated figures for the final weeks of 1947 to obtain a complete review of the year's activities. A final report will be prepared about the middle of February.

An increase in the production of motor fuel at the expense of middle distillates is indicated by the data on refinery operations which was compiled from reports of 94 refineries and 10 treating and blending plants in the state. Thompson said he had noticed this trend which is somewhat surprising in view of the extremely heavy demand for burning oils. The commission chairman added that the matter of refinery yields is simply one of dollars and cents and declared that when demand for burning oils pushes prices of these products to a point where they are more profitable, then the production trends will change. A refinery official in Houston said it must also be remembered that motor-fuel demand last summer also was at record levels and that distillate-fuel yields the latter part of the year would show improvement.

In natural-gasoline and related operations, during 1947 the production of liquid hydrocarbons from gas totaled 71,164,492 bbl. against 65,196,131 bbl. in 1946 and 59,738,721 bbl. in 1945.

The number of gasoline plants in Texas rose from 134 in 1946 to 143 in 1947, and pressure-maintenance and repressuring plants from 138 to 142. The report showed a drop in the number of cycling plants from 32 to 30 at the end of 1947.

Carbon-black production during the past year totaled 808,090,632 lb. compared to 753,707,237 lb. during 1946 and 668,052,090 lb. during 1945. At the end of 1947, Texas had a total of 5,261 gas wells producing, out of a total of 8,623 gas wells. Gas wells at the end of 1946 were 7,894; producing gas wells numbered 5,122. Texas had a total of 831 gas fields with 1,724 gas reservoirs at the end of 1947 as compared to 761 fields and 1,471 reservoirs at the end of 1946. Wildcat gas wells drilling at the end of 1947 totaled 63 against 69 at the end of 1946.

TEXAS REFINERY OPERATIONS
(Figures in barrels)

	Runs to stills		
	1947	1946	1945
Crude oil	517,765,078	512,690,861	491,430,903
Cracking stock	4,773,622	5,133,312	4,569,700
Gasoline	374,982	440,248	1,393,684
Kerosine, distillate and/or gas oil	5,223,693	4,847,612	6,951,955
Fuel oil	444,583	285,278	269,769
Natural gasoline	13,624,677	11,940,482	15,721,865
Miscellaneous	13,192,316	10,220,942	8,654,025
Total	555,398,951	545,558,735	529,018,901
PRODUCTION			
Crude oil	18,634	3,613	12,950
Cracking stock	7,609,473	9,258,902	10,607,058
Gasoline	231,983,339	215,745,518	219,856,236
Kerosine and/or gas oil	123,063,121	124,900,383	97,402,753
Fuel oil	140,455,439	143,789,785	139,372,424
Natural gasoline	21,970	41,580	325,831
Miscellaneous	23,286,262	26,117,464	24,793,775
Total	526,438,238	519,857,245	492,371,027

Elk Hills Extension Fought by Industry

LOS ANGELES.—The authority of the Secretary of the Interior or the President to extend the boundaries of the Elk Hills Naval Reserve by executive order was challenged by California oil industry witnesses at a Department of Interior hearing here January 15. Only Congress has that authority, it was asserted.

The hearing, conducted by C. Girard Davidson, assistant secretary of the Interior, was the outgrowth of the request by the Secretary of the Navy that the Secretary of the Interior issue a temporary withdrawal order covering 6,800 acres outside the reserve for the purpose of extending its boundaries to the west and south. The Navy maintains that Stevens zone production on the Elk Hills structure extends outside the present limits of the reserve and the extension is asked to permit exploratory drilling to determine the limits of production and to protect the structures comprising Elk Hills field from future drainage.

Standard Oil Co. of California is principally affected by the proposed extension as it owns in fee 4,300 acres of the 6,800 acres which the Navy wants added to the reserve. However, witnesses who appeared to oppose the extension included, in addition to F. S. Bryant, vice president of Standard, Robert E. Paradise, representing the Western Oil and Gas Association, Rush Blodget, executive vice president of the Oil Producers Agency, and several lessors of government land affected by the proposed extension.

Synthetic Rubber Program Framed in New Legislation

WASHINGTON. — Legislation providing for the maintenance of a domestic synthetic-rubber industry with an annual capacity of 600,000 tons of general-purpose and 75,000 tons special-purpose rubber was introduced in Congress January 19 by Rep. Paul Shafer of Michigan, chairman of a House armed services subcommittee which has been investigating the subject.

Under the bill, the President would have authority to exercise allocation, specification and inventory controls over both natural and synthetic rubber, and it provides that he shall require the use annually of a minimum of 200,000 long tons of general-purpose and 25,000 tons of special rubber. To protect the industry the President would be authorized to impose import restrictions on rubber products. Such production capacity as not required to fill the demand created by the compulsory use of synthetic would be kept in standby condition.

Other provisions of the bill would authorize the President to determine what plants are to be operated, so that consideration can be given geographic dispersal of plants as well as diversity of manufacturing processes, and require that at least one alcohol-butadiene plant will always be available. Research, production, and sale of synthetic would be handled by an agency designated by the President.

Sale of plants is authorized under the bill under conditions which will insure the purposes of the measure are carried out.

Throughout the bill, synthetic rubber is referred to as "American-made rubber," a term which Shafer said is preferred by manufacturers and consumers.

International

WORLD-WIDE OIL DEVELOPMENTS

Occupation Officials Are Planning Exploration Program in Germany

THE first large-scale exploratory program ever to be initiated in Germany is scheduled to get under way shortly in the British and United States zones, according to information released to Reuters by the American Military Government in Berlin.

As such a survey is an expensive undertaking and must be handled in the most competent manner, it is probable that it will be conducted on a pool basis by a number of United States, British and Dutch oil companies. The larger part of German oil production is currently in the United States and British zones, with the majority in the latter, as explained in some detail by The Oil and Gas Journal, December 27, 1947, page 142. These oil interests will operate in the bi-zonal area by invitation of the American Military Government and the British Control Commission.

Aside from seeking adequate indigenous crude-oil production to take care of Germany's postwar demands, the United States and British governments are interested in discovering additional production which will obviate the need for United States and British taxpayers to spend approximately $50,000,000 yearly for crude oil and petroleum-product imports to maintain that country's postwar economy.

While the entire oil production from the area now known as the American Occupational Zone, in Germany, totals only around 4,000 tons yearly (82 bbl. daily), production in the British Occupational Zone, before the war, reportedly reached 600,000 tons (12,300 bbl. daily), mostly in the Hamburg area. The probabilities of finding additional crude oil reserves in this area are thought quite favorable by United States geological and geophysical authorities.

Indicative of the initial cost of Germany's new exploratory program in tht Bavarian Basin and other areas in that country, is the fact that the American Military Government's first step, according to Gen. Lucius D. Clay, military governor, was to order two seismic reflection units from a Denver, Colo., firm at a cost of about $22,000 each. Cost of the entire survey, of course, will be considerably above $44,000. American dollars paid for exported German consumer goods are being allocated to the project, to pay for this equipment, by the Joint Export-Import Agency, an official of the oil section of the American Military Government has explained.

Complete Survey Never Made

Should a large pool be found in Bavaria, it is believed that the Joint Export-Import Agency would be repaid many times over for its original investment in crude oil and petroleum products. During the past year a number of top United States oil experts have visited Germany, and it was on a basis of these experts' reports that the decision was taken to order a comprehensive survey. For according to the reports the Germans have never made a complete survey of oil possibilities in their country. Preliminary examinations made by the United States oil authorities convinced the American Military Government that the surface structure of the Bavarian Basin indicates a strong possibility that crude oil, in large commercial quantities, may yet be found beneath this area.

At first, it was proposed to have this survey conducted by German geologists and technicians, but later it was felt that the operation should be under the guidance of Americans with up-to-date exploratory equipment. This survey reportedly will be only the first step in a long-range program which could not possibly repay the extensive financial outlay for many years. The area to be covered includes most of Bavaria, from Ulm on the French Occupational Zone border to Passau on the Danube, and south from the present producing area around Munich to the Austrian border.

In addition, all present and potential oil areas in the British zone will be surveyed, both around the Hamburg and Hanover oil fields and in Schleswig-Holstein, where oil recently has been discovered.

Trans-Arabian Pipe Line Work Will Be Resumed

NEW YORK.—Within the next 2 months, Trans-Arabian Pipe Line Co. expects to resume construction work on the western end of its 1,040-mile 30-31-in. crude-oil line from Saudi Arabia's Abqaiq field to Sidon on the Lebanese coast, according to a high-ranking official interviewed in New York last week by The Oil and Gas Journal.

Work has been halted temporarily due to the political agitation there engendered by the United Nations decision to partition Palestine. And to prevent any American from being injured, Trans-Arabian withdrew its crews pending further clarification.

At the time the oil official remarked that work probably would resume within 2 months, he said this was based largely on assumption that the United States would not send troops to Palestine. Since then President Truman has officially stated that United States troops will not enter Palestine.

Officials of the Arabian countries, including Saudi Arabia's King Ibn Saud, have been assured by high-ranking United States oil company officials that the U.N. decision was one in which the oil companies in no way participated. In view of this, it is expected that the Syrian Parliament, which has so far delayed ratification of Trans-Arabian's transit rights, will shortly give its approval. Only about 200 miles of the big-inch line is outside of Saudi Arabia where King Saud has assured the oil companies that they will receive every cooperation and that their oil properties will be protected.

Oil Prospects of China as Related To the Carbon Ratio

by Weng Wen-Po

IN 1915, White[1] postulated the carbon-ratio theory. The ratio of the fixed carbon to fixed carbon plus volatile matter increases from the soft bituminous coal regions to the anthracite regions, and in passing from soft to harder coal regions this ratio also passes a line beyond which no commercial oil may be expected.

The postulation has offered a tentative explanation of the distribution of the oil and gas fields in the Mid-Continent and the Appalachian regions of the United States. Since then, the theory has been viewed with some reserve and skepticism.

As long as the carbon ratio is influenced by the regional metamorphism, it is possible to make some use of it, especially if the influence happens to be strong. The picture of the carbon ratio may be compared with the reflection from a distorted mirror. The image is a result of the object as well as the distorted mirror surface, so the mirror may not be true enough for portraiture, but is still able to reveal what the object is.

Looking at the problem in this light, we propose to employ the method in a broad regional sense. Our work in China has shown that such application is justifiable. By plotting the carbon ratio of the whole country in one map, it looks as though the local sedimentary factors are not quite so important. In the first place, the isocarbs closely follow the tectonic trend. Secondly all the oil-shale deposits, which cannot retain their composition in high temperatures, fall in the low-carbon-ratio area. Lastly, all the oil and gas seepages fall within the low-carbon-ratio regions.

The data of the coal analysis used in this work are mainly taken from the publications of the Geological Survey of China[2] and the Geological Survey of Sze-chuan.[3] Figures from various other sources are also added. In many cases, the average value is taken. In a few other cases, the least-square mean is computed and the probable error of each single observation estimated. We find that the probable error is usually less than 5 to 10 per cent.

Our computation results in the two text figures. In one of them is shown the isocarbs of the Carboniferous and Permian coals. In the other figure are the isocarbs of the Jurassic coals which occur in many outcrops and mines. From the two figures, we are in a position to divide the country into several provinces of low metamorphism at which we look with particular interest.

Three Great Zones

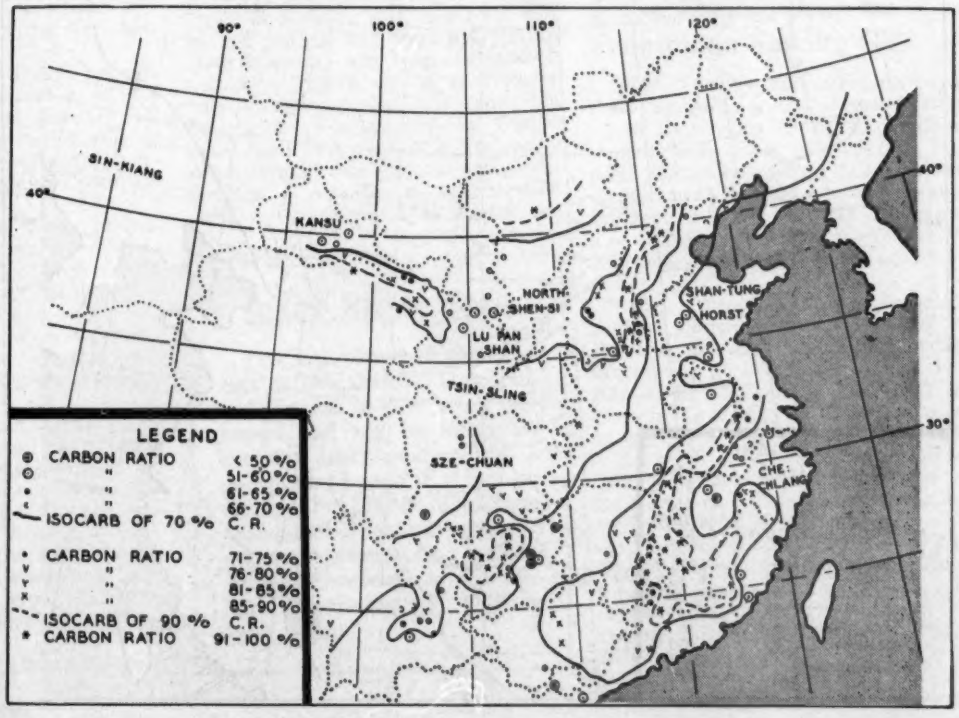
The pictures of the carbon ratio reveal to us three great zones of low metamorphism. First, a great area of low metamorphism is found in the country's northwest. The area seems to include the great internal draining basins of Zongor, Tarim, Tsaidam, and the corridor of Kan-su. There are numerous known oil seepages, including several surface deposits where asphalt may be mined.

International
WORLDWIDE OIL DEVELOPMENTS

THE AUTHOR

Upon graduation from Tsin-hua University in 1934, Weng Wen-Po joined the Peiping Academy as a research assistant. After 2 years at the academy, he studied applied geophysics in England. During the war he served as a teacher in Central University and then as geophysicist in the Kan-su Petroleum Administration. Later he became director of the exploration department of Chinese Petroleum Corp. This article is abstracted from an unpublished monograph, "The Petroleum Resources of China."

China—Map showing test points and isocarbs of Permian coal



Most of the known seepages are found in the Tertiary formation which varies from Marine and brackish water facies in the western part to the continental formations in the east. In several other cases, oil seeps out from upper Mesozoic or older beds. It appears every exploratory drilling is rewarded with discovery.

According to T. K. Huang et al[4], in a Wusu oil field, some exploration has been done since 1938. Three of the successful wells yield a total daily production of 210 bbl. with some gas. The initial production of some wells seems to be fairly large. Well No. 39 is said to have given an initial daily production of 280 bbl. in 1943.

Further to east the Yumen oil field has been explored since 1939. According to L. G. Weeks, of Standard Oil Co. (N.J.)[5], about 30 wells have been drilled, and production has run as high as 3,000 bbl. daily of 33° A.P.I. oil. The oil reservoir is in the Tertiary sands. It is estimated the total reserve to be 50-100 million barrels, of which about 3 million barrels have been extracted.

It seems the great desert area has promising possibilities. On the other hand this extensive and promising area lacks the necessary means of transportation. Before a railroad is completed, the difficulties at all stages of development would be serious enough to limit it to a small-scale operation.

According to rule 9 of the pending Chinese mining law, the exploitation of oil is defined as a government enterprise. Although there is a clause to permit leasing of the exploitation rights yet the strict definition will prevent the desire to develop these rich resources from acting as a motive for an oil rush to the northwest. So the oil industry and the railway will be politely waiting for each other to move first.

To the east of Longitude 104° E., the low metamorphic province become a Mesozoic area. In the eastern Kan-su some active oil showings are found and some of them are quite impressive. Most of the seepages are found in the upper Mesozoic rocks. In Shen-si province, scores of small oil seepages are found in the continental Mesozoic beds. All of them are flimsy in proportion and some are transient in character. One or two small structures are still being exploited on a small scale from a shallow depth. It seems that the Cretaceous has some promise in the Kan-su area, and the deeper formations in the Shen-si basin may prove to be productive.

Sze-chuan Basin

Down to the south, the red basin of Sze-chuan forms a cul-de-sac of the great province. We have no data to show that the carbon ratio inside the great ring of Tsinling is low enough to form the neck of the cul-de-sac. On the other hand, active oil seepages are found in the Jurassic coal seam in the Tsinling area. However, it has been proven beyond all doubt that there is considerable gas reserve in that basin. Up to now, half of the exploratory drilling has been rewarded by the discovery of commercial gas. One well has produced 4,000,000 cu. ft of gas daily.

The second zone of low metamorphism falls in a long and narrow belt of a very important tectonic trend, known by some geologists as the Cathaysian geosyncline. The zone starts from the middle portion of the northeast provinces of Manchuria and extends down to French Indo-China. The low-lying area is covered up in considerable length by the flood plains of some major rivers. The area is maily floored with the marine Paleozoic and Triassic rocks with basins of younger rocks.

The part of the Cathaysian geosyncline[6] in the North China has offered very little attraction to petroleum geologists in the past.

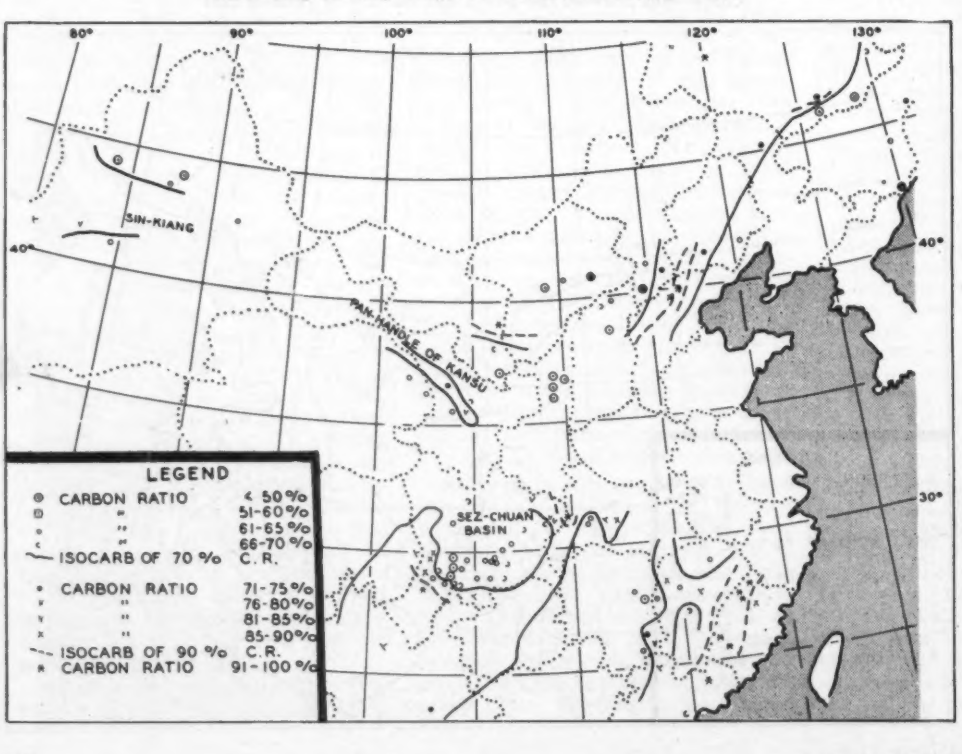
However, oil surface indications are found in the northeastern provinces. During World War II, a number of wells were drilled in the Japanese-occupied area, and optimistic reports made about the number of the wells which produced some oil. As far as we are now aware the results were not very encouraging.

According to Stach[7], a mineral-resources survey was conducted by the Japanese Kwantung Army from 1932 to 1934. Between 1933 and 1937, some exploratory drilling for coal yielded some cores with strong oil indications. During 1938-42 detailed geological and torsion-balance surveys were made by Manchuria Petroleum Co. and Manchuria Mining Exploration Co. Drilling began in 1939 and continued until the end of the war. Of the 82 wells drilled, 7 produced less than 410 bbl. The wells were drilled to about 6,000 ft. on the Ching-homing anticline in Fushin area, in a Mesozoic graben flanked by the Sinian range. The oil-bearing formation was found in the 3,300 ft. of black shale of the lower part of the Jurassic.

In the Dalai Nor area, a total of 33 wells were drilled on the gently dipping Jurassic beds unconformably overlying igneous rocks. The drilling revealed several successive flows

(Continued on 131)

China—Map showing test points and isocarbs of Jurassic coal



Toledo Refinery Strike Ended After 296 Days

A STRIKE which kept idle for 296 days the Toledo refinery of Pure Oil Co. ended January 19 when more than 250 workers went back to their jobs.

A new contract, signed the previous day by Local 346 of Oil Workers International Union (C.I.O.), parallels the industry pattern on wages, hours of work, and working conditions, and includes revised grievance procedure. The contract runs to December 31, 1948.

The refinery employs 375 workers and processes 27,000 bbl. daily. During the long shutdown, most employes had other jobs but almost all are expected to return to the refinery within 10 days.

Some equipment should be operating in 3 weeks, Supt. David Frank said this morning, with full operations under way by mid-March. Rehabilitation work on plant equipment is being expedited.

The Toledo refinery strike was last to be settled of a four-cornered attempt last March by O.W.I.U. to force the company into national bargaining. Other points involved were the company's largest refinery at Nederland, Tex., and the oil field and refinery at Cabin Creek, W. Va. All were settled locally, with other operations back at work last July.

Drillers Pick Houston For Fall Convention

HOUSTON. — The 1948 convention of the American Association of Oilwell Drilling Contractors will be held in Houston some time the first half of October.

This decision was made at a meeting of officers and directors of the organization in Dallas January 13. Exact date of the convention will be decided after conferences with Houston hotel managers to avoid conflicts with other meetings.

The convention will bring an expected 800 visitors from all oil-producing states in the country. Lester D. Cain, of L. D. Cain Drilling Co. and head of the Houston chapter of the association, is now drawing up appointments to the arrangements committee which will make plans for the meeting.

In line with the A.A.O.D.C. policy inaugurated last year of rotating meetings of its directors among the larger cities in the oil states, the next session of the directors has been set for New Orleans April 6, according to Brad Mills, Dallas, executive secretary. The association has some 1,250 members of all types representing about 1,500 rotary rigs. There are 58 directors.

Following the Dallas directors' meeting, a reception was held in Houston January 14 at the Houston Club honoring E. C. Brown, head of Brown Drilling Co., Long Beach, Calif., and president of the national association. About 400 persons attended.

S.A.E. Installs Pigott; Hears Holaday on Octane

DETROIT.—R. J. S. Pigott, chief engineer of Gulf Research & Development Co., Pittsburgh, was installed as president of the Society of Automotive Engineers at the Society's annual meeting here last week.

One of the highlights of the convention was an address by W. M. Holaday of Socony-Vacuum Laboratories, New York, urging automobile designers not to plan on more extensive use of high-octane gasoline in the near future in view of the high refinery investment and scarcity of the petroleum fractions involved. A special report on this meeting appears on page 129 of this issue of The Oil and Gas Journal.

Stone & Webster Corp. Buys E. B. Badger & Sons

The engineering firm of E. B. Badger & Sons Co., which specializes in petroleum refining and chemical process engineering and construction, has been purchased by Stone & Webster, Inc., for an undisclosed cash price, it was announced by the two concerns in New York January 15.

The purchase was made, Stone & Webster explained, for the purpose of expanding the engineering and construction activities of its subsidiary, Stone & Webster Engineering Corp., in the process and industrial fields. Both concerns are long-established and well known; Stone & Webster was established in 1888 and the Badger firm originated in Boston more than 100 years ago. For many years Badger has held a prominent position in the process engineering field and currently lists among the clients for whom it has undertaken important contracts both here and abroad many large concerns engaged in the refining of petroleum and petroleum products and in the manufacture of chemicals.

For the present the two concerns will continue to operate as individual entities, but the announcement said that the technical ability and experience of both organizations will be directed toward offering broader and more comprehensive services to their clients.

Index Ready Soon

The complete editorial index of The Oil and Gas Journal for 1947 is now being prepared and will be ready for mailing early next month. It will not be bound in a regular Journal, but will be available, without charge, separately to subscribers requesting a copy. Address requests to Circulation Department, P. O. Box 1260, Tulsa.

East Texas Well Pressure Up Little in December

AUSTIN.—A relatively small pressure increase of 1.88 psi. for East Texas field during December has been reported to the Texas Railroad Commission.

The commission will set the state's February allowable following the statewide meeting January 20. At the present time, East Texas is the only field in the state subject to shutdown days, all other areas being allowed to produce at their full maximum efficient rate in view of current heavy demand for crude oil.

East Texas field has been on a 20-day producing schedule the last several months. Commission officials said greater production would lower bottom-hole pressure. E. O. Thompson, commission chairman, said pressure increased 2 psi. in the field in October and 5 psi. in November in contrast to the 1.88-psi. increase in December. East Texas field salt-water injection in December was 509,529 bbl. daily, down 7,843 bbl. daily from November.

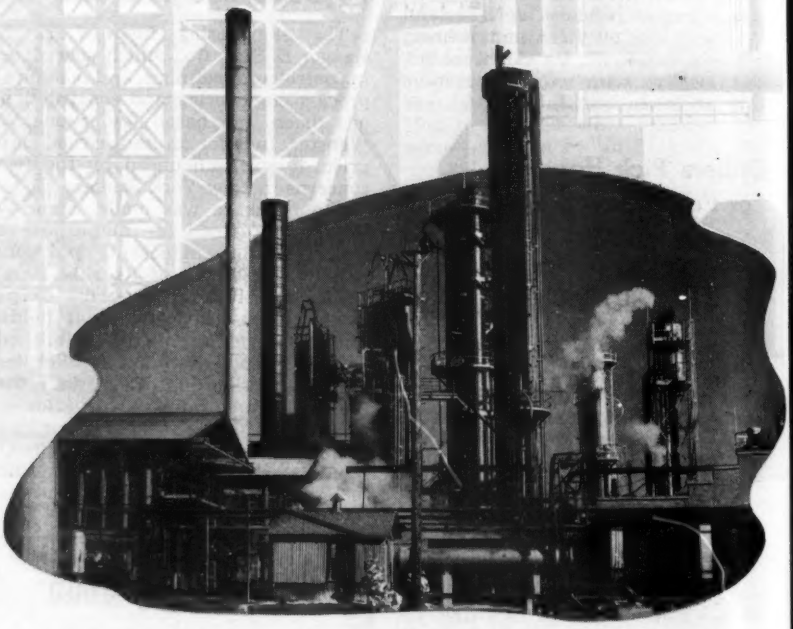
Active Bidding Seen for Venezuelan Royalty Oil

NEW YORK.—The announcement that Venezuela is considering taking all of its royalty oil in kind rather than in cash, made last week by Dr. Jose Martorano, acting head of the development ministry, was followed by reports here that two concerns are actively interested in long-term contracts for this oil at premium prices.

Petrol Terminal Corp., Philadelphia, is understood to be seeking to purchase a refinery with a capacity of between 15,000 and 30,000 bbl. per day to be shipped to Venezuela to process the royalty oil. Petrol figured in the deal last fall in which the Venezuelan government contracted to sell about 25 per cent of its royalty crude, all of which is being shipped to points outside the country.

It is also reported that one of the largest crude-oil producing companies in Venezuela is negotiating with the Government to purchase all of the company's royalty oil on a long-term firm basis.

What makes a Smaller Refinery Big



ry Big Business?

The size of a refinery measured in barrels per day capacity is one thing. Its competitive ability . . . its flexibility of product and adaptability to changing market requirements is another. The latter makes the difference between just refining and big business.

Taking advantage of Universal's facilities . . . of Universal research, engineering, processes and service . . . many refineries of moderate capacity have become big business operations. These refineries, UOP licensees, have found big business to be good business.

Why not follow the example of these licensees . . . and find out what Universal means to the smaller refinery.

UNIVERSAL OIL PRODUCTS COMPANY

General Offices: 310 S. MICHIGAN AVE. UOP CHICAGO 4, ILLINOIS, U. S. A.

LABORATORIES: RIVERSIDE, ILLINOIS

Universal Service Protects Your Refinery

WASHINGTON WATCHING

BY BERTRAM F. LINZ

Controls Gain Favor

WASHINGTON.—Industry representatives in Washington believe that some sort of legislation giving the President authority to tighten up on distribution of scarce materials will come out of hearings now going on before the Senate banking and currency committee, and there is a chance it might get through the Senate, but they are confident the House will take no action along that line this year.

Sen. Charles W. Tobey of New Hampshire, chairman of the committee, is said to have told friends that while there is no Republican bill pending he believes the committee has a responsibility to go into the matter of inflation, and it is pointed out that Tobey seldom brings anything up in his committee without the intention of writing legislation.

The committee shortly will hear the testimony of industry witnesses, who will try to sell it the proposition that rationing will only make present conditions worse, not cure them.

Meanwhile, the voluntary agreements situation is becoming increasingly involved, and the idea is spreading that the administration is trying to sabotage the Taft plan to permit industry to take cooperative action to alleviate shortages.

Commerce Department officials are still putting on pressure for mandatory controls and have said that if allocation programs—for steel, for instance—cover as much as 20 per cent of production it will be necessary to have over-all allocation.

As an example of administration tactics to discredit the voluntary programs, it is said that Commerce Department staff had ready tentative proposals for the allocation of steel for the oil, agricultural implement, and freight car industries but on the eve of the January 8 conference with the industry was told to hold them up.

Truman Plugs for Controls

DESPITE the cold reception given his State of the Union and budget messages, President Truman last week bull-doggedly pressed his demand for his 10-point antiinflation program and 11-cent-a-day tax reduction.

In his economic report, the President, expressing doubt that our capacity to produce fuels and energy is being expanded fast enough to meet the demands arising through expansion in other lines of industry, called for "increased emphasis" upon research, development of substitutes and importation, and declared that "new techniques and sources of supply from coal, natural gas and oil shale will have to be increasingly relied upon to prevent the reserve situation from deteriorating and to meet the rapidly growing demand."

While few members of Congress took issue with the facts presented in the 136-page economic report, the President's reiteration of his demands for authority to control prices and distribution brought the same divided reaction as they had in the past.

To bolster the argument for controls, the report carried figures on the profits of producer-refiners showing that in the first three quarters of last year, after taxes, 45 companies had profits of $323,000,000 against $281,000,000 for all of 1946. It also referred to price increases which, on the whole, have been above the levels necessary to furnish incentive and funds for expansion of business.

But while the President argued for controls which the industry believes would eliminate the "incentive and funds for expansion of business," he also told Congress that what this country needs is maintenance of a "truly competitive" system of free enterprise.

The President's idea of competitive industry, it is gathered from his report, would be concerns whose size would be limited to that necessary to secure the benefits of technical efficiency, firmly policed by a strong Department of Justice to check the further concentration of industrial control and reverse the past trend toward concentration.

Europe's Oil Needs

THE State Department last week added 17 more volumes to the spate of reports on the European recovery program from which, by dint of a lot of digging, it is possible to get the "best current" of a series of current estimates of the amounts of oil which will go to the 16 non-Soviet nations and western Germany during the first 15 months of the plan.

The latest figures place the imports of those countries during the period from April 1, next, to June 30, 1949, at 63,191,000 metric tons, a cut of 319,000 tons from the previous "latest estimates" released 10 days earlier.

The department warned, however, that even the latest revision is subject to revision and, it said, the figures are primarily intended to be illustrative. "It is, of course, impossible to forecast the exact pattern or quantity of trade," it explained.

The department now estimates that 28,993,000 tons of the oil to be imported by Europe during the 15-month period will be from the United States and 34,198,000 tons will be from areas outside the Western Hemisphere.

The estimates take into account the oil which the European countries themselves are expected to produce during the fiscal year 1949, approximately 2,419,000 tons, but no information is available on what they may produce during the last 3 months of the current fiscal year. This production for 1948 is placed at 655,000 tons for the United Kingdom, 909,000 for Austria, 469,000 for Germany, 209,000 for the Netherlands, 81,000 for France, 53,000 for Sweden, 29,000 for Belgium - Luxemburg, 13,000 for Switzerland, and 1,000 for Ireland.

The latest figures provide for imports by Austria of 62,000 tons during the 15-month period; Belgium-Luxemburg, 2,321,000 tons; Belgian dependencies, 403,000; Denmark, 2,044,000; France, 9,263,000; French dependencies, 1,834,000 during the fiscal year 1949; Greece, 925,000; Iceland, 153,000; Ireland, 852,000; Netherlands, 3,191,000; Norway, 1,369,000; Portugal, 966,000; Sweden, 3,705,000; Switzerland, 1,289,000; Turkey, 423,000; United Kingdom, 23,073,000; British dependencies, 4,205,000; and Germany, 1,442,000.

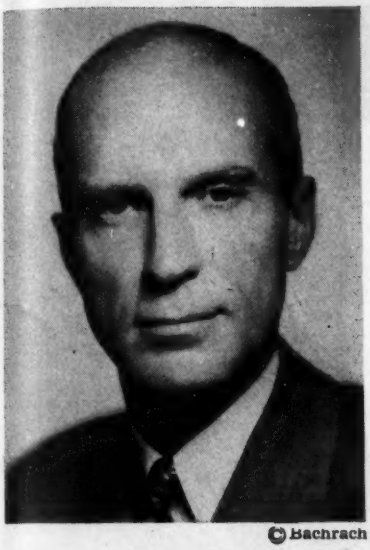
Lobbyists Under Fire

A SPECIAL group in the Department of Justice is making an intensive investigation of lobbying activities and compliance with the registration act passed by Congress last year.

Among other things, the investigators are digging into the activities of certain oil company representatives who are not registered as lobbyists, apparently with a view to determining whether their actions constitute lobbying within the meaning of the law.

It is also reported that the department is interested in expenditures for lobbying. Since decisions whether such expenditures are deductible as "reasonable" business expenses is the responsibility of Commissioner of Internal Revenue and there is nothing in the registration act dealing with the subject, it is believed the department is seeking to learn whether money has been spent for political purposes, which does not come under its jurisdiction.

PERSONALS



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Bahrein's Refining Head Has Broad Experience

ALMOST 25 years in the oil business and 14 years of that in research and development work and executive leadership in California refineries, is the record of Howard B. Nichols, recently named vice president in charge of refining of Bahrein Petroleum Co., Ltd. He was also elected assistant vice president in charge of refining of California Texas Oil Co., Ltd. Both companies are subsidiaries of Standard Oil Co. of California and The Texas Co.

Since 1923 Nichols has been engaged in petroleum refining. He began his oil career immediately after graduating from Stanford University with a degree in engineering.

During the early thirties Nichols specialized in cracking processes, and for 7 years was in charge of all plant and laboratory research and development work on cracking and related refining processes.

He assisted in the design of the Bahrein refinery, on which construction began in 1936, and he became manager of research and development of Bahrein Petroleum in January 1938. In 1944 he was elected assistant vice president of the company.

A. A. Buzzi, manager of the accounting department, has been appointed assistant treasurer of Shell Oil Co., Inc., to replace **William H. Garbade,** who recently became president of the Deep Rock Oil Corp., Tulsa. Buzzi in 1941 transferred to Shell's head office in New York as assistant manager of the auditing department. He became manager of the department in 1944 and manager of the accounting department in 1946. **J. M. Flaherty,** manager of the auditing department, will become manager of the accounting department. Flaherty will be replaced by **Allen Howard,** assistant manager of the auditing department, and Howard will be replaced by **W. G. Precobb,** office manager at Shell's Wood River refinery.

John L. Leeper, Oklahoma City, has been made toolpusher and manager of tools for **A. R. Jordan,** Hugo, Okla., and will operate out of Oklahoma City.

Thomas Lee Robey, formerly assistant superintendent of production for Washington Gas Light Co., Washington, D. C., has been appointed coordinator of gas production research for the American Gas Association. Robey is now assistant to **Dr. Newcomb K. Chaney** who was named research consultant of the gas production and general technical research program last November 1.

Joseph Zaba, consulting petroleum engineer of Houston, has been appointed chief mechanical engineering supervisor of Stanolind Oil & Gas Co. with headquarters in Tulsa. He was born in Poland and received a degree in mining engineering from the Academy of Mines in Austria. He came to the United States in 1924 and 1 year later received the degree of master of science from University of Pittsburgh. For several years he was in charge of engineering operations for Rio Bravo Oil Co. and later the D. D. Feldman interests. In recent years he has been a frequent contributor on engineering and operating subjects to The Oil and Gas Journal and Petroleo Interamericano and is now completing a series on modern rotary drilling for the Journal.

Murray Neumann, consulting geologist for Carter Oil Co., retired early this week after 32 years of continuous company service. Neumann joined Carter in 1916 as one of its first geologists, becoming chief geologist 2 years later. In 1934 he became consulting geologist for Carter exploration activities, graduating from Oklahoma A. & M. College in 1910. He spent 3 years on geological studies at the University of Missouri.

PAUL HUBBARD

E. P. Hubbard, assistant superintendent of production for Gulf Oil Corp. in Houston, has been named superintendent of production effective February 1 succeeding **W. C. Clemons,** who is retiring after a 44-year career with Gulf organization. Hubbard has been with Gulf since 1920 and has been assistant superintendent of production the last 12 years. He was graduated from Texas A. & M. College in 1917 and taught engineering there for 1 year prior to joining Gulf. **J. M. Cooper,** chief petroleum engineer for Gulf, was made assistant superintendent of production succeeding Hubbard. Cooper will be succeeded by **E. L. Petree.**

E. O. Buck, former consulting geologist and engineer and more recently southern manager of Rowan Drilling Co., has become associated with the National Bank of Commerce, Houston, as manager of its oil loan department.

R. H. Sherman, a vice president of Creole Petroleum Corp. and head of the producing section of Creole's New York office, has resigned to accept a position with Standard Oil Co. (N.J.) as assistant coordinator of producing activities. He will continue as a director of Creole. **A. Freie,** formerly production manager of Creole in Caracas, Venezuela, will succeed Sherman as head of the producing section in New York. Freie has spent the last 17 years in Venezuela in geological and producing activities.

J. F. Anderson, formerly chief geophysicist for the Geophysical Engineering Co., Tulsa, has been appointed head of the geophysical department of Warren Oil Corp., Houston. After graduating from Rice Institute in 1933 Anderson joined the geophysical department of Sun Oil Co. at Beaumont, Tex., He resigned in 1945 to join Geophysical Engineering Co.

Lloyd L. Jordan, chief engineer for the Arkansas Oil and Gas Commission for the past 4 years, has resigned to become a natural-gas engineer in the gas-gasoline division

Announcing

the

CAMERON-NUWELL

line of

CEMENTING EQUIPMENT

In keeping with the Cameron policy of constantly improving and expanding its services to the industry, it is with pleasure we announce the purchase of the assets of Nuwell Tool Company, effective December 15.

The Nuwell Tool Company has been dissolved. The products formerly manufactured by that company are now being produced and distributed by Cameron Iron Works.

Cameron is proud to bring the industry these excellent cementing tools which have already won the praise of numerous operators.

HERE'S HOW TO REDUCE YOUR SQUEEZE JOB EXPENSE

The FLO-MASTER line of cementing shoes and collars was introduced in 1941 to present a patented design which provides positive control of the direction of flow of fluid or cement slurry: (1) *Downward*—while casing is run into the hole to the desired depth, the ENTIRE flow of fluid is directed through the nose of the shoe at high velocity to wash away bridges and to flush cavings and cuttings from the bottom of the hole. (2) *Laterally*—closing the axial opening in the nose of the shoe by dropping a diverter ball into the casing and pumping it down to a seat in the shoe, automatically opens lateral ports so that the ENTIRE volume of cement slurry is distributed laterally against the walls of the hole. This provides a powerful scouring action to remove filter cake, and tends to center pipe in the hole and cause the cement to rise in a column around the pipe.

No other side-opening type cementing shoes and collars can provide these features, which are responsible for the high percentage of successful primary cement jobs credited to FLO-MASTER.

A descriptive brochure has been prepared and will gladly be sent to interested operators on request.

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Export: 74 Trinity Place, New York, N. Y. West Texas: Midland (Telephone 1982). Oklahoma: 310 Thompson Bldg., Tulsa. California: Long Beach (P. O. Box 267). Wyoming: 356 N. Wolcott St., Casper, North Louisiana: Bossier City (P. O. Box 425).

of Shell Oil Co., Inc., and has been assigned to the New Orleans area. **J. W. Sanders, Jr.,** has succeeded Jordan on the commission.

W. B. Poor, chief engineer of Tennessee Gas Transmission Co., has resigned to join Ford, Bacon & Davis

W. B. POOR

W. C. McGEE

in connection with the construction of the 1,096-mile, 22 and 26-in. natural-gas pipe line of Michigan-Wisconsin Pipe Line Co. from Hugoton field to Michigan. Poor is expected to make his headquarters in Kansas City, Mo. A graduate of Ohio State University, Poor has been closely associated with T.G.T.'s expansion during the last 3½ years. Before joining T.G.T., he was supervising engineer for United Gas Pipe Line Co. for 12 years.

W. C. McGee, formerly assistant to the vice president in charge of operations, handling dispatching and measurement, has been appointed chief engineer of Tennessee Gas Transmission Co. succeeding Poor. A 1931 graduate of Texas A. & M. College, he was chief dispatcher for Northern Natural Gas Co. from 1931 to 1944 when he joined T.G.T. **E. S. Murray,** formerly design engineer, has been named to the new position of assistant chief engineer for T.G.T. **C. S. Coates,** formerly assistant to **J. P. Bristow,** vice president, has been named to the new position of general superintendent, and **O. H. Moore,** in charge of compressor stations as Bristow's assistant, becomes assistant general superintendent.

W. H. Collins, production division manager for Shell Oil Co., Inc., for North Texas at Wichita Falls, has been named area production superintendent at Tulsa. Collins will be succeeded by **J. W. Roche,** who has been Wichita Falls division production engineer since 1935.

J. C. Johnston, Stanolind Oil & Gas Co. geologist in the Wichita office, has been transferred to Jackson, Miss., as district geologist for the Mississippi and Alabama area. **Caldwell Starkey** has returned to the Stanolind geological department after doing consulting work. He will be stationed in Lake Charles, La.

Mike Hamilton, consulting geologist at Fort Worth, has been named geologist and production engineer for Faultline Oil Co., Oklahoma City.

Derek F. Mitchell, who has been in Iran for the past year for Anglo-Iranian Oil Co., Ltd., has been transferred to the New York office where he will work for the company's U.S. representative, **B. R. Jackson.**

Paul Van Over, formerly with Northern Pipe Line Co. at Sterling, Mich., is now stationed in Muskegon, Mich., where he is general superintendent of gas pipe lines for Campbell, Wyant & Cannon Foundry Co.

Comdr. William S. Comstock, who for the past 2 years has been in the Los Angeles office of the Inspector of Naval Petroleum Reserves, has joined Franco Western Oil Co. and Franco Wyoming Oil Co. as chief geologist.

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ANDREW NEILSON

Andrew Neilson, who has a background of 25 years of shipping experience, has been elected president of Overseas Tankship Corp., an affiliate of California-Texas Oil Co., Ltd. He replaces **Adm. Andrew F. Carter** who has joined Pacific Tankers, Inc., as its president. Most of Neilson's experience has been with affiliates of The Texas Co. and Standard Oil Co. of California, joint owners of Caltex. He joined Overseas Tankship as vice president and general manager in June 1946. This company is currently operating 50 tankers in overseas service.

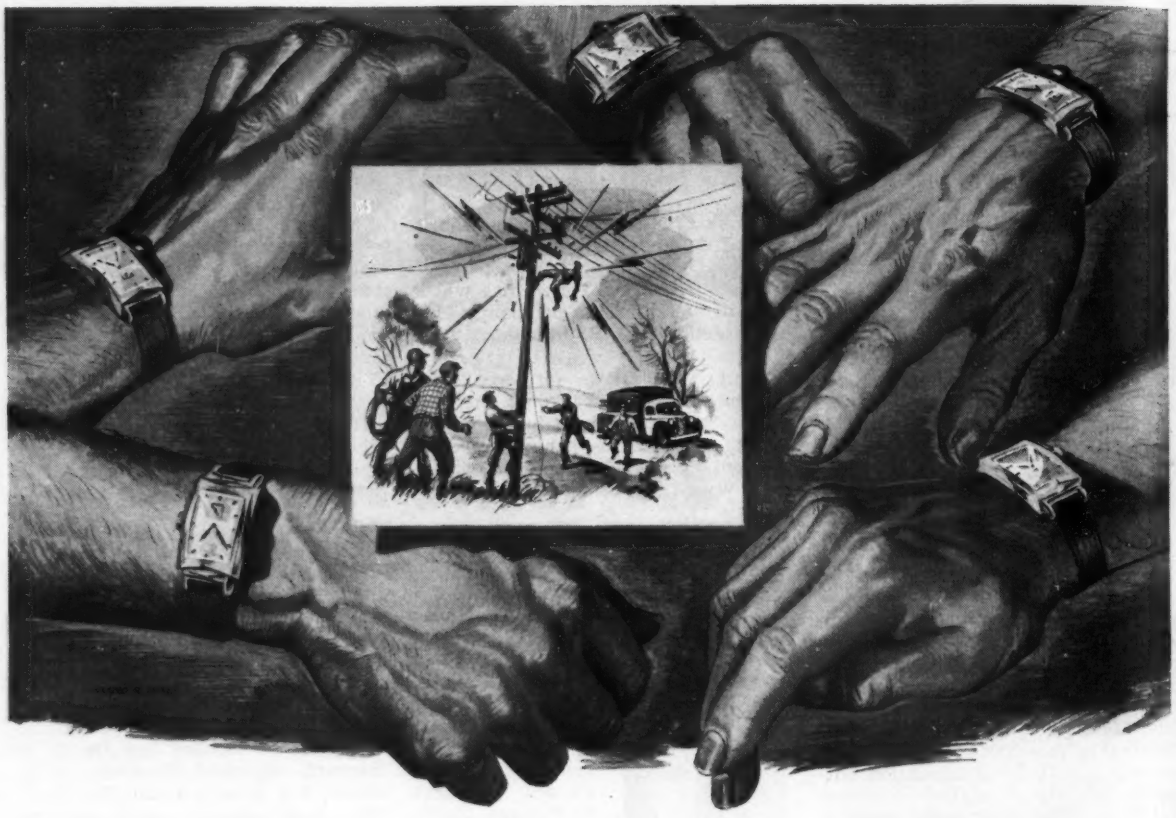
Thomas E. Sunderland, general counsel, Pan American Petroleum & Transport Co., has been elected to the board of directors and executive committee of that company. He succeeds the late Buell F. Jones of Chicago. Sunderland, a colonel in the U. S. Army Air Forces, rejoined Pan American after the war. He had previously been associated with several important New York law firms.

J. J. Hanna, plant superintendent for the Imperial Oil, Ltd., refinery at Regina, has been placed in charge of that plant. Hanna began his refining career 42 years ago at the Standard Oil Co. (Ind.) refinery at Whiting, Ind. He succeeds **Clarence M. Moore,** who has been in charge of the Regina refinery since its construction in 1922.

Dr. W. H. Bahlke and **Dr. D. P. Barnard,** associate directors of research for Standard Oil Co. (Ind.), have been named research coordinators, a new position recently established by the company. Bahlke will coordinate the company's development work in the rapidly expanding field of chemicals from petroleum; Barnard will continue his liaison activities with product quality and technical developments in the automotive and aviation industries.

W. S. S. Rodgers, board chairman of The Texas Co., vice chairman of Arabian American Oil Co., returned to New York last week after visiting King Ibn Saud and traveling extensively around the Middle East. **B. E.**

New officers of the Middle District Producers Association elected at their meeting last week in Oil City, Pa., are pictured here. Left to right: Stanley Bayless, Sr., independent oil producer, Titusville, Pa., vice president; Miles Blanchard, assistant manager of Patoil Corp., Pleasantville, treasurer; W. J. Brawley, manager of Northern Ordnance, Pleasantville, and first president of the association, chairman of the board of directors; Chauncey Gray, assistant manager of Patoil Corp., president; and Frank E. Lyons, of the Pennsylvania Gas and Oil Management Associates of Oil City, secretary



Six Workers + E-M Foresight = Five Heroes

Employers Mutuals Job Safety Training seemed "dull stuff" until the moment of tense drama came . . .

All six men of the power-line crew had received Employers Mutuals safety training... wondered whether such "dull routine stuff" was necessary, until one day—

A severe electric shock hurtled one of their number from a pole, his clothing aflame. His five mates, ready for such emergency, quickly beat out the flames, loosened his clothing, induced artificial respiration, had him well on the way to recovery within a half hour.

Each received a gold watch from Employers Mutuals in recognition of his part in saving a fellow worker's life.

Throughout industry, in every type of business, thousands of men and women are taught such life-saving practices, trained how to act in an emergency by Employers Mutuals engineers and industrial nurses.

Skill in accident prevention, control of industrial health hazards, development of first aid programs . . . all are accomplished with a tactful, human approach that builds good will and makes Employers Mutuals services unique in the insurance field.

Employers Mutuals write: Workmen's Compensation—Public Liability—Automobile—Group Health and Accident—Burglary—Plate Glass—Fidelity Bonds—and other casualty insurance. Fire—Extended Coverage—Inland Marine—and allied lines. All policies are nonassessable.

Your plant accident experience materially affects the cost of your workmen's compensation insurance. Send for Employers Mutuals' booklet, "Safety Engineering." It explains the importance of such facilities and experience in keeping your accidents under control. Also be sure to have our "Dictionary of Insurance Terms." It will help you to understand the provisions of your policies. Send for these valuable, informative booklets on your letterhead—or call your local Employers Mutuals man.

Employers Mutuals Policies Protect Lives, Health and Property

EMPLOYERS MUTUALS OF WAUSAU

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EMPLOYERS MUTUALS OF WAUSAU

EMPLOYERS MUTUAL LIABILITY INSURANCE COMPANY OF WISCONSIN
EMPLOYERS MUTUAL FIRE INSURANCE COMPANY
HOME OFFICE: WAUSAU, WISCONSIN
Offices in Principal Cities—Consult Your Telephone Directory

Hull, president of Trans-Arabian Pipe Line Co., has also returned to the United States.

Gale L. Adams, manager of the manufacturing department for General Petroleum Corp., has been named

G. L. ADAMS

J. C. SAMPLE

A. J. DONNELLY

C. M. WAGNER

a vice president and director of the company. He was one of four executives recently elected to new offices in the company. Adams joined the company in 1925, and later served as chemical engineer, supervisor of process laboratories, assistant manager of the laboratory department, manager of that department, and assistant manager of manufacturing.

John C. Sample, former general sales manager for General Petroleum, has been named vice president of the company. He was transferred to General Petroleum from Standard-Vacuum Oil Co. in 1938 after 17 years in Japan and Korea, where he advanced to assistant division manager. He became general sales manager in 1943.

Arthur J. Donnelly, industrial relations manager, has been named a vice president of the company. He joined General Petroleum in 1924. He was elected to the board of directors in 1945 after a year's service as manager of industrial relations.

Carroll M. Wagner, manager of the geological department, has been chosen a director. He joined the company as field geologist in 1919, and in 1932 he became manager of the geological department. He has participated on behalf of Socony-Vacuum Oil Co., Inc., in exploration work and development of oil fields in Canada, Mexico, Argentina, Venezuela, and Colombia.

Ira H. Cram, assistant chief geologist of Pure Oil Co. at Chicago, has been appointed manager of exploration, a newly created position.

H. L. Schultz, vice president and director of Standard-Vacuum Oil Co., has retired after 36 years of service with the company. He spent about 30 years in Far Eastern marketing operations before returning to New York to become a director in December 1941 and vice president in January 1944. Schultz attended Columbia University and City College of New York, from which he graduated in 1909 with a B.S. degree. He will make his permanent home in Hillsborough, Calif.

Elmo G. Weyel, petroleum engineer in the Midland headquarters of the oil and gas division of the Railroad Commission of Texas, for District 8, has been transferred to a new branch office opened by the commission at Lubbock, Tex.

Carlos Ferguson, Magnolia Petroleum Co., has been elected president of the Panhandle Geological Society. Other new officers are: **R. J. Gutru,** Cities Service Oil Co., vice president, and **Fred Alexander,** Standard Oil Co. of Texas, secretary-treasurer.

SHIFTS—

Robert F. Cory, engineer, The Texas Co., Long Beach to Fellows, Calif.; **Bruce S. Ainsworth, Jr.,** engineer, Celanese Corp. of America, Kinsville to Bishop, Tex.; **Jack T. Duree,** engineer, Pure Oil Co., Midland, Tex., to Jal, N. M.; **J. Fike Godfrey,** engineer, Phillips Petroleum Co., Phillips to Spur, Tex.; **Curtis F. Jarrell,** engineer, Globe Oil & Refining Co., Lockhart to Paris, Ill.

D. P. Couch, superintendent, Pure Oil Co., Bay City, Mich., to Norfolk, Va.; **Oiva John Karna,** engineer, Lummus Co., Port Chester, N. Y., to Port Neches, Tex.; **Tom Cline,** superintendent, Barnsdall Oil Co., Oklahoma City to Shreveport, La.; **J. W. Dix,** engineer, Barnsdall Oil Co., Oklahoma City, to New Orleans, La.; **Albert J. Kunkel, Jr.,** engineer, Stanolind Oil & Gas Co., Brownfield to White City, Tex.

E. C. Thomson, superintendent, Sun Oil Co., Nederland to Liberty, Tex.; **J. M. Meyers,** foreman, Helmerich & Payne, Inc., Graham to Wichita Falls, Tex.; **R. C. Pusey,** engineer, Stanolind Oil & Gas Co., Iraan to Andrews, Tex.; **Waldo R. Shrier,** foreman, Skelly Oil Co., Kermit, Tex., to Velma, Okla.; **H. G. Shimp,** engineer, Houdry Process Corp., Media to Springfield, Pa.; **W. A. Waldroop,** engineer, Northern Natural Gas Co., Clifton, Kans., to Sunray, Tex.

G. W. Swank, superintendent, Parker Drilling Co., Laramie to Cody, Wyo.; **H. H. Rushing,** superintendent, Rocky Mountain Drilling Co., Rock Springs, Wyo., to Whittier, Calif.; **John E. McCall,** geologist, California Co., Durant to Marietta, Okla.; **Richard Williams,** geologist, Seismic Engineering Co., Palestine, Tex., to Rawlins, Wyo.

N. F. Jones, superintendent, Interstate Oil Pipe Line Co., Wewoka to Tulsa; **Sam Phelps,** engineer, Interstate Pipe Line Co., Wewoka, to Tulsa; **Robert J. Moffatt,** geologist, Carter Oil Co., Tulsa, to Shreveport, La.

DEATHS

Raymond M. Parker, Jr., 54, former president of Hartol Petroleum Corp. and vice president of Richfield Oil Corp. of New York from 1929 to 1933, died January 9 in New York. He began his oil career with Union Petroleum Co., Philadelphia. Later he was district manager of Sinclair Refining Co., and from 1923 to 1929 was vice president of Acewood Petroleum Co., Philadelphia.

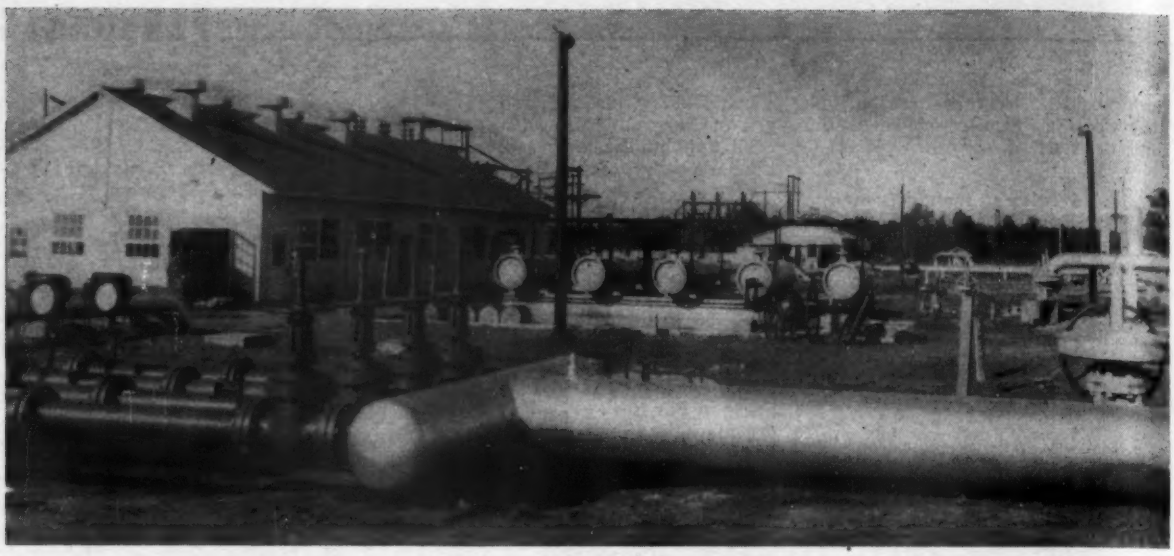
De Olen Pugh, 46, sales representative for Byron Jackson Co., Los Angeles, in the Oklahoma and Kansas area for the past 24 years, died January 11 in Tulsa.

Thomas R. Bounds, 61, retired district superintendent for Humble Oil & Refining Co., died January 14 in Richmond, Tex.

Henry J. Flake, 68, general credit manager of The Texas Co. prior to his retirement 3 years ago, died January 13 in Houston.

William Ward Wasson, 59, president and secretary of Wasson & Co., Inc., oil and natural gas producers, of Pittsburgh, Pa., died January 15 in Pittsburgh.

H. Glenn D'Spain, 48, executive vice president of National Gas & Oil Corp., Newark, Ohio, and the Ohio Oil and Gas Association, died January 14 in Meredith, N. H.



Little Rock facilities now equipped with centrifugal compressors for gas transmission: 20-in. station for former products line in foreground; 24-in. station for former crude-oil line in distance. Recently installed header and meter installation in front

Texas Eastern Operates First High-Pressure Gas-Transmission Centrifugal Compressors

by Paul Reed

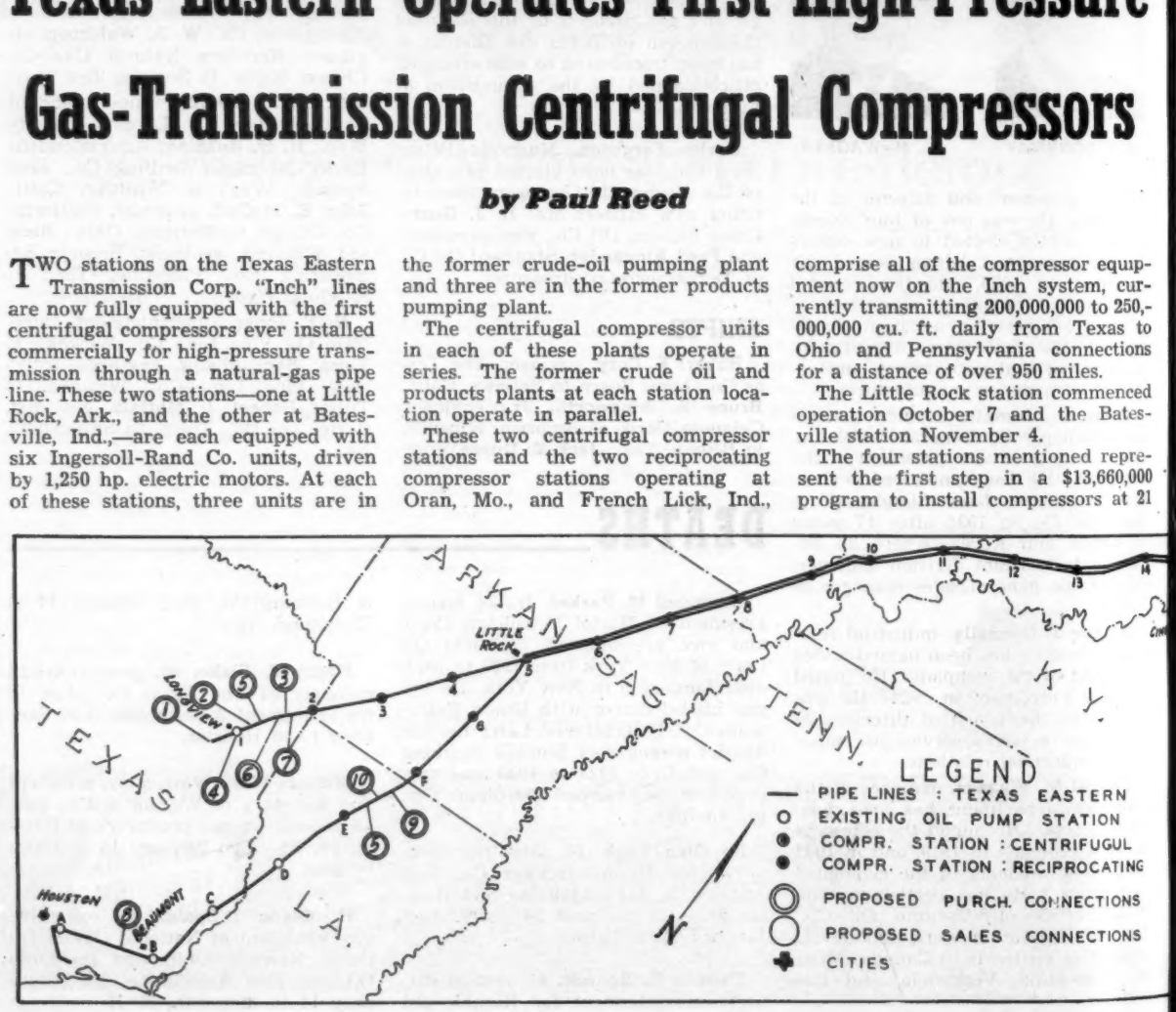
TWO stations on the Texas Eastern Transmission Corp. "Inch" lines are now fully equipped with the first centrifugal compressors ever installed commercially for high-pressure transmission through a natural-gas pipe line. These two stations—one at Little Rock, Ark., and the other at Batesville, Ind.,—are each equipped with six Ingersoll-Rand Co. units, driven by 1,250 hp. electric motors. At each of these stations, three units are in the former crude-oil pumping plant and three are in the former products pumping plant.

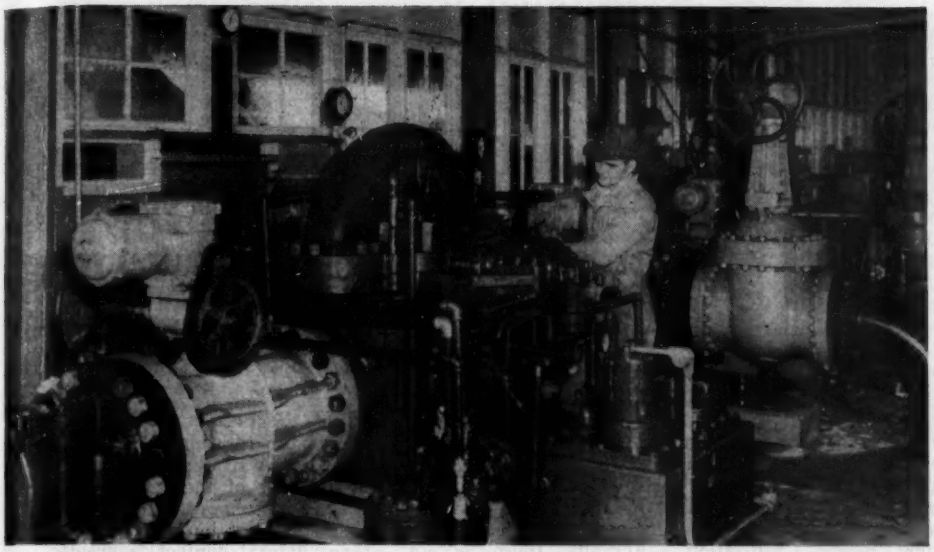
The centrifugal compressor units in each of these plants operate in series. The former crude oil and products plants at each station location operate in parallel.

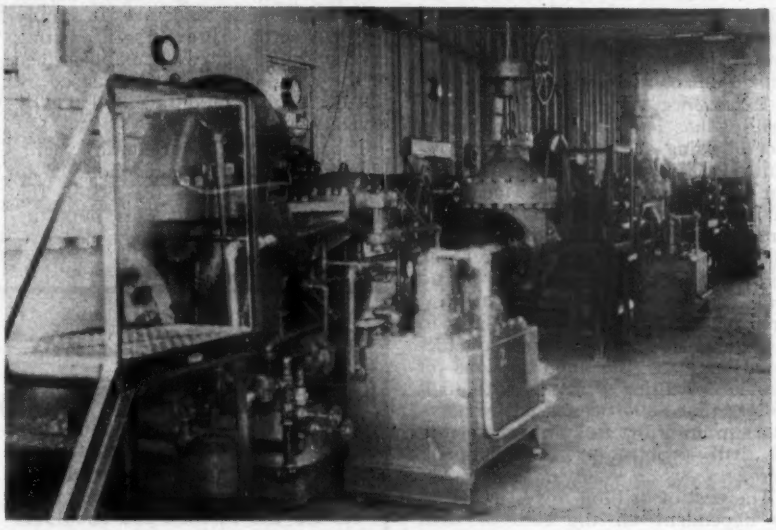
These two centrifugal compressor stations and the two reciprocating compressor stations operating at Oran, Mo., and French Lick, Ind., comprise all of the compressor equipment now on the Inch system, currently transmitting 200,000,000 to 250,000,000 cu. ft. daily from Texas to Ohio and Pennsylvania connections for a distance of over 950 miles.

The Little Rock station commenced operation October 7 and the Batesville station November 4.

The four stations mentioned represent the first step in a $13,660,000 program to install compressors at 21







Centrifugal compressors at Little Rock installed by Texas Eastern to replace centrifugal pumps of the same flange-to-flange dimensions. Equipment in front of each centrifugal compressor is to facilitate the handling of shaft seal oil, which is circulated by means of pumps, located in the motor room of each station which is separated from the compressor room by a fire wall. No changes have been made in valves and piping, within the stations, originally installed for wartime crude oil and products service. (Left) Twenty-inch line (Little Big Inch) station. (Below) Twenty-four-inch line (Big Inch) station

stations in 1947 and 1948, of which 16 will be centrifugal and 5 reciprocating.

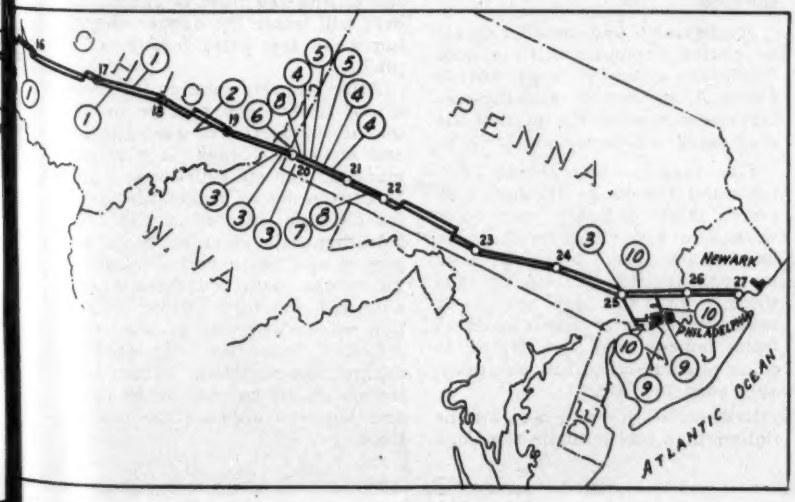
It is recognized that these installations initiate the most revolutionary development which has occurred in natural-gas transmission. The effect on future construction of the industry promises to be far reaching. Not only is first cost lower but compactness of centrifugal compressor equipment brings numerous obvious economies resulting from smaller foundations and station buildings. Units may be manufactured, installed, and overhauled more quickly. Altogether centrifugals have less than 10 per cent as many parts as reciprocating units. Simplicity of design is reflected in easier operation and maintenance.

A unit may be installed within 10 days to 2 weeks where the foundation is ready. While the author was at Little Rock one unit was completely dismantled and assembled in the course of an 8-hour working day.

Although the Texas Eastern program is based on data justifying a three-to-one preponderance of centrifugals over reciprocating units in the current program, it is too early to discuss comparative costs.

At the outset the decision of Texas Eastern to utilize centrifugals led to a technical venture which called for considerable financial courage on the part of the organizers of the company. Credit is given to the engineering

(Continued on page 130)



MAP OF TERRITORY SERVED BY TEXAS EASTERN TRANSMISSION CORP.

Purchase connections: (1) Lone Star Gas Co.; (2) Whelan Bros.; (3) Ark. La. Gas Co.; (4) United Gas Pipeline Co.; (5) H. L. Hunt; (6) P. H. Pewitt; (7) Stewart Petroleum Co. and Atlantic Refining Co.; (8) McCarthy Oil & Gas Co.; (9) Hassie Hunt Trust; (10) Southwestern Production Co. and The California Co.

Sales connections: (1) Ohio Fuel Gas Co.; (2) East Ohio Gas Co.; (3) Manufacturers Light & Heat Co.; (4) Equitable Gas Co.; (5) Carnegie Natural Gas Co.; (6) United Natural Gas Co.; (7) New York State Natural Gas Corp.; (8) Peoples Natural Gas Co.; (9) Philadelphia Gas Works Co.; (10) Philadelphia Electric Co.

Drill Collars

THEIR USE AND MANUFACTURE

*by R. J. Stoup**

USE of drill collars in rotary drill strings has undergone a process of evolution by trial and error methods since early in the development of rotary drilling. Of particular significance in recent years has been the discovery that long, straight, heavy-walled sections of pipe just above the bit are beneficial in two ways. First, the rate of drill penetration is increased. Second, the number of drill-pipe failures is reduced.

Experience through years of rotary drilling has led to the general practice of using drill collars and has resulted in considerable refinement in the manufacture and the technique of using them. The first collars were undoubtedly picked up more or less at random from heavy pipe or bored in field shops from whatever material was available. Now, however, drill collars are standard products of a number of reputable manufacturers. Some of the modifications of standard drilling practice with drill collars that have been used by operators in an effort to increase the rate of drill penetration are discussed here.

The cost of drilling a well is largely dependent on the rate of drill penetration. Any change in drilling methods that reduces the over-all time for successful completion of a well, and that does not abuse the equipment so as to cause its premature failure, reduces the total cost of drilling.

The generally accepted theory of advantageous use of drill collars is as follows: Drill pipe in the thousands of feet length used in a well is extremely flexible. Were the bit attached directly to the bottom drill pipe tool joint and the total weight of the string, or enough of it for satisfactory drilling, allowed to rest on the bottom of the hole, it would immediately buckle into a complicated spiral curve inside the hole. The load on the bit would vary in a complex manner as the pipe rotated, depending upon how the sides of the hole supported part of the load. This would prevent drilling a straight hole and would subject sections of the pipe to severe repeated bending action during rotation. This bending action, repeated with every turn of the pipe, results in a phenomenon known as "fatigue," just as in a wire bent back and forth to break it. The effect is sometimes erroneously called "crystallization." Actually there is no change in the size or nature of the crystalline metal structure. It simply breaks across previously existing crystal planes. The brittle appearance of the resultant fracture is caused by the mechanism of failure and not by crystallization.

The remedy for premature drill-pipe failures and crooked holes is to add more weight on the bit in the form of drill collars. This puts the necessary weight for good penetration at the bottom of the hole and permits the rotating drill pipe to be in tension. A straighter hole is drilled and bending of the drill pipe is reduced. Furthermore, since there is little sidewise motion and the pressure of any lateral contact is greatly reduced, wear on pipe and tool joints is lessened. When sufficient drill collars are used, the drill pipe transmits only the torque of the rotary table and acts vertically as a conductor string for the drilling mud.

How Much Weight?

In calculating the weight to keep drill pipe in tension, the buoyancy of the mud must be considered. In 9.8-lb. mud (approximately 73 lb. per

*Development metallurgist, Spang-Chalfant division, National Supply Co.

Recommendations on

CARE AND USE OF DRILL COLLARS

To prevent premature failure, drill collars require attention in service. First, before running drill collars, the threads and shoulders should be examined carefully. Damaged areas should be repaired. Sometimes damage can be corrected with a fine file but if this is not possible, the joints should be reshopped.

Joint threads and shoulder should be coated copiously with a good lubricant which is kept strictly clean. A number of metallic-base lubricants now on the market are considered satisfactory.

First time in a hole, the drill collar stand should be stabbed with more than ordinary care and walked in with chain tongs. If the hand chain cannot bring the joint to approximate shouldering, the threads and shoulder should be examined again to assure freedom from damage that would tend to cause seizing and galling and probably ruin the joint.

Drill-collar joints should be tighter than tool joints in the same string. To assure this some operators use a snatch block on the tongs with approximately the same number of wraps on the cathead as used for tool joints. The extra torque thus secured is considered essential in keeping long, heavy drill-collar strings tightly made up. The extra care in inspecting and lubricating the threads and shoulders will lessen the danger of galling when this extra torque is applied.

After properly running the joints a few times, they become broken in, the surfaces have good contact, and are cold worked. It is recommended that all drill-collar joints be broken out at periodic intervals for cleaning, inspecting and relubricating. After cleaning, boxes and pins should be inspected carefully for cracks, damaged threads, and damaged shoulders. Close inspection may save a fishing job.

Collars must be kept straight during transportation. Thread protectors should be used on all joints and removed only on the derrick floor.

cu. ft.) for example, steel loses about 15 per cent of its weight. Thus a drill-collar assembly weighing 10,000 lb. in air would weigh only 8,500 lb. when suspended in the drilling fluid. To put 15,000 lb. on the bit in 9.8-lb. mud, the weight of drill collars, subs, reamers, etc., must be 17,700 lb. In heavier muds the increase in drill-collar weight must be proportionately greater.

Since 17,700 lb. would place the neutral point, i.e., the point of change from compression to tension, at the top of the drill collars, there would be no leeway for errors in the weight indicator or for careless handling of the brake lever. Therefore, to assure that the drill pipe is always in tension, good practice is to utilize 50 per cent more drill-collar weight than is to be carried on the bit and disregard the effect of mud buoyancies. Thus for 15,000 lb. on the bit, 22,500 lb. of drill collars would be used.

Although this is recognized as good drilling technique in any territory, certain limitations, which are discussed further on, have prevented universal acceptance. Within recent years, however, changes toward increased drilling weight above that required to keep the drill pipe in tension have been made principally in West Texas where troubles have been experienced in maintaining an adequate rate of penetration in drilling deep wells in hard formations. In West Texas, occasional occurrence of the extremely hard "chert" streaks below 7,000 ft. has added tremendously to drilling difficulties.

When technical progress made it feasible, the problem of drilling chert and other hard formations was solved by adding more weight on the bit in the form of drill collars. This advance was not practicable until rock-bit manufacturers designed new types of bits that could stand a load of 5,000 lb. per inch of bit diameter instead of the former 1,000-2,000 lb. per inch.

The significance of such an increase is apparent from the fact that efficient drilling requires each bit tooth to penetrate the formation and break out chips of rock. The hardness of the formation governs its resistance to tooth penetration. Other factors being equal, efficient drilling in the hardest rock depends upon applying greater weight on the teeth and, most important of all, allowing adequate time to penetrate the formation. A bit can be rotated so rapidly that it does not dig into the material but rides rapidly over the high spots like a fast car on a rough road, merely wearing out the teeth without enough effect on the underlying rock.

Rock bits are now available with harder teeth in an improved pattern and with greater bearing strength, lessening the danger of fishing for lost bit cones. These bits may even drill more footage per bit in this severe service than older-type bits in softer formations.

While this drilling practice of putting an extremely heavy weight on the bit, in combination with slow rotation was solving the problem of drilling through hard dolomites and limestones, it was also found that a high unit load of this type was profitable in drilling some of the easier formations of the Permian basin. Practically all drilling contractors and company rigs in this locality have adopted the practice of adding more weight on the bit than is required to keep the drill pipe in tension. Strings of more than 600 ft. of drill collars are not uncommon in West Texas.

Drill-Collar Problems

Discussion of such an important advance in drilling technique should include consideration of some of the factors that have kept operators in other areas from adopting similar practices. Contractors in other localities have given five principal objections to long multiple strings of collars: joint trouble, fishing difficulties, handling difficulties, deviation from straightness in drilling, and high initial cost.

1. The joint problem.—Inability to keep the collars together has always been recognized as the leading difficulty in long collar strings. For satisfactory results with long multiple drill collar strings, it is absolutely necessary to use utmost care and vigilance in every detail of procedure in making, breaking, and inspecting the threaded connections. Long, heavy, rigid drill-collar sections impose high stresses on joint connections, and neglect of caution can lead to frequent failures. Some operators who have used no more than average care in handling and running collars have abandoned the practice of long strings of collars and returned to drilling with the pipe in compression because of many joint breaks.

The most common drill-collar break starts at the pin end, usually near the last full thread at the shoulder, and a progressive fracture finally severs the pin. Fig. 1 shows a typical field failure of this type.

Less frequently a break starts in the last engaged thread in the box and by a similar action travels to the outside. This is illustrated in Fig. 2. Box failures of this type can sometimes be caught in the rotary table at the first appearance of the crack

(Continued on page 88)

On the following two pages are pictures showing the steps taken in the manufacture of drill collars, together with explanatory discussion.

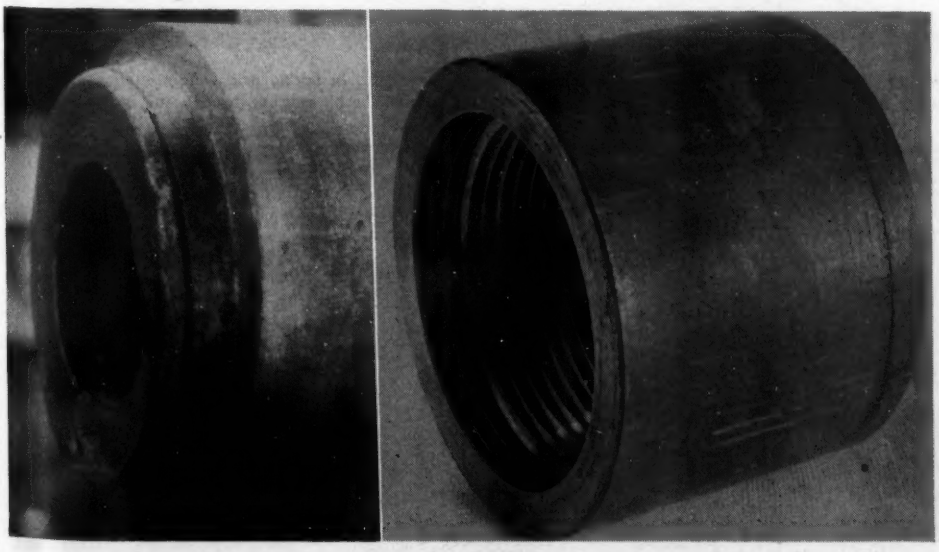


Fig. 1—(Extreme left) The most common drill-collar break starts at the pin end, usually near the last full thread at the shoulder. A progressive fracture finally severs the pin

Fig. 2—(Left) Sometimes a drill collar break starts in the last engaged thread in the box and travels to the outside

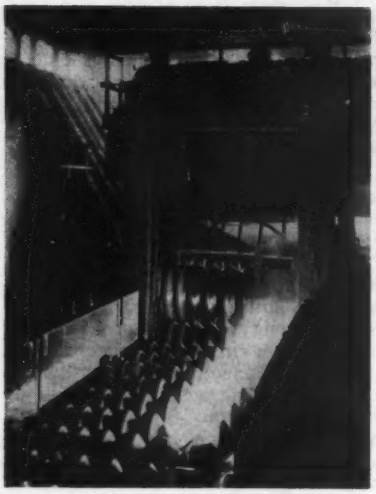


Fig. 1—A 32-in. reversing mill is used in this Spang-Chalfant operation to produce rolled rounds for drill collar stock

DRILL-COLLAR MANUFACTURE

MATERIAL FOR COLLARS.—It is now becoming general practice to supply a chromium molybdenum steel, 4140 or 4142. The prewar nickel-chromium steels such as 3140 and others have never shown any particular advantage for this application and though occasionally specified, they are losing favor.

The chrome-moly steels in the fine-grained condition have a satisfactory hardening power and good ductility. They are easily machined and in manufacture show less tendency to internal ruptures than some of the other grades.

Use of straight carbon steels is practically obsolete except in emergencies. During the war a large number of gun barrels were made from a modification of the 4140 analysis and have good performance records in this exacting service.

SHAPING COLLARS.—(Fig. 1) To shape steel ingots or blooms into the proper form for collars so that finish machining can be carried out without too much loss of metal, it has been standard practice for a number of years to use press or hammer forging. It is true that certain complicated shapes such as rock-bit bodies are hard to fabricate by other methods than forging and that ordinarily the makers of drill collars also make these other items, so that the tendency is to forge drill collars also. However, a logical way to shape drill collars is by rolling through grooved rolls, as shown in Fig. 1.

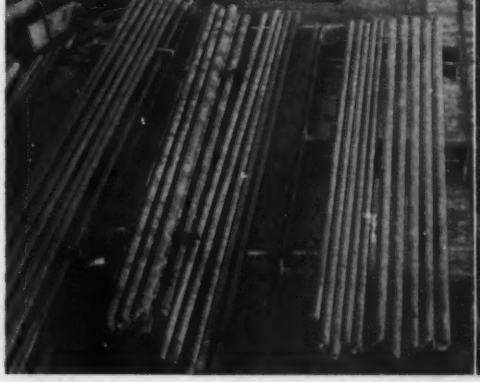
Since for a long time most collars were forged, the belief has grown that in some mysterious way forging imparts special properties to steel that no other method of fabrication can do. It took World War II to prove that it is possible and practicable to produce by rolling with equivalent quality such vital equipment as large guns which had previously been forged exclusively. Length requirements of collars impose a difficult condition when press forging to shape drill-collar stock. Long objects of small cross-section cool rapidly as the forging proceeds and reheating is usually necessary. Part of the drill collar is worked at a high temperature when just out of the furnace and from there on down until it is so cold it has to be reheated.

HEAT TREATMENT.—(Figs. 2, 3, 4). Since ordinary hot-worked steel, even of medium alloy content, is too soft for the required service conditions, especially at the joint ends, heat treatment is necessary in getting a satisfactory combination of strength and ductility. The recommended heat treatment includes an over-all quench followed by tempering. The photos shown are of the equipment used for this operation at the Spang-Chalfant division of National Supply Co.

The furnace itself (in the rear of Fig. 2) is of the car-bottom type in which the collars are supported horizontally during heat treatment. After being held at the quenching temperature for a sufficient period, five collars are removed at a time by the special handling fixture. They are then totally immersed in a highly agitated quench-oil tank. (Fig. 3 shows the start of a quench.) The agitation on the 42,000-gal.-capacity tank is supplied by 26 three-bladed propellers mounted on the side in staggered relation, each driven by a 15-hp. motor. Both furnace and quench tank are long enough to process 54-ft. collars. After tem-

Fig. 2—(Above, left) Here is a new horizontal car-bottom furnace, oil-quench tank, and special handling rig, all part of the heat-treating facilities for drill collars; location, Ambridge, Pa. Fig. 3—(Above, right) The handling rig has five drill collars in position over quench tank

Fig. 4—(Below, left) Heat-treated drill collars show very little warping. Fig. 5—(Below, right) In boring drill collars, cutting oil is introduced under pressure through a packing around the boring bar. It washes chips away from the bit and out through end of the boring bar



pering, the collars are warped very little, as shown in Fig. 4, by two representative loads of collars on the right.

STRAIGHTENING. — Collars are fairly straight after heat treatment but any noticeable bend is too much. The allowable variation for straightness is ⅛ in. regardless of length. A large majority of collars must be press straightened to attain this tolerance. This is done by most manufacturers using the conventional vertical ram press similar to, but larger than, that seen frequently in the oil fields.

Since press straightening requires bending the outer fibers beyond the elastic limit, it induces internal stresses around the circumference that might affect service unfavorably. In other words, under severe drilling conditions the locked in stresses might tend to spring the collar back. The recommended stress relieving treatment is heating to 1,000° F. for several hours. This is usually impracticable to do in the field and any cold straightening done at the rig must be recognized as only a temporary measure.

HEAT TREATING.—In heat treating collars, using a quench and temper, most manufacturers aim to obtain a hardness about equivalent to tool joints or perhaps somewhat less. Too soft a collar means the threads will deform under load and either strip or work loose and cause a wobble failure. Although according to theory the strength of the material has no effect on the amount of bending in column loading, a soft collar will kink much easier and cause severe stresses to be imposed on the joint ends. If a collar is too hard, a treacherous brittle condition may result and cause sudden failure. Collar hardness in the range of 270-340 Brinell is satisfactory.

HARDNESS.—There are two schools of thought on the effect of the hardness of the collar in resisting wear. One group holds that hardness does not have much importance until it rises to quite high values approaching that of the components of the formation. Others maintain that the benefit of increasing hardness is almost directly proportional to wear resistance. In any event, with present methods of manufacture moderate surface hardening is a difficult problem which adds sharply to the cost of the collar. Better results have been obtained in combating wear by the use of carbides such as tungsten, boron, etc., in the form of wear bands fused into the surface of the collar at the points of maximum wear.

There has been some tendency among users to specify for collars a minimum longitudinal Izod impact value generally in the neighborhood of 40 ft.-lb. If the intent is to obtain better fatigue strength, it can be stated definitely that no relation exists between the results of the impact test and the behavior of the material to notch sensitivity in fatigue. If the intent is to evaluate the "brittleness" of the collar, notched-bar impact tests such as Izod or Charpy give only vague indications and not proof in regard to the shock resistance of the steel.

These statements can be reviewed in such recent works on mechanical testing of materials as: 1939 Edition of Metals Handbook, page 671; Gillett—Metallic Materials, page 123; Moore—Materials of Engineering, page 62.

MACHINING.—(Figs. 5, 6). Machining of collars is an ordinary lathe job complicated as far as boring is concerned by the length of the piece. Whether the boring is done from one end or both ends at once, it is general practice to use a circulating system just the reverse of oil-well drilling, that is, cutting oil is introduced through packing around the boring bar, goes under pressure to the bit, and washes the chips out through the bar (see Fig. 5).

One difficulty in boring collars is to produce the required accuracy. It requires the highest type of equipment and workmanship to do this consistently. The A.P.I. requires a 10-ft.-long drift bar ⅛ in. smaller than the nominal bore to pass freely through the collar from end to end. This assures free passage for wire-line coring equipment, survey instruments, etc., but does not guarantee freedom from a possible bore deviation which might result in dangerously thin wall at some point. Drill-collar manufacturers now usually survey the bore for possible inaccuracies using some such method as shown in Fig. 6 where a surveyor's transit is mounted away from the end of the collar and a target is passed through the bore.

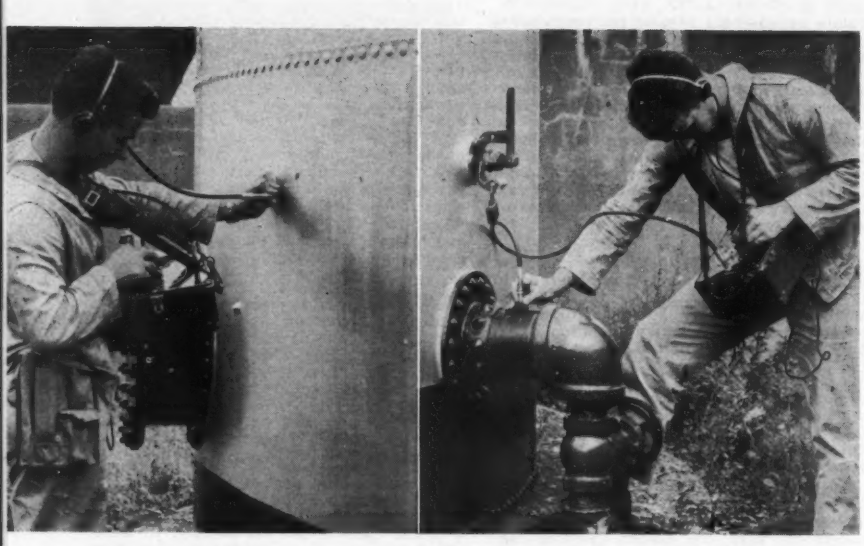
THREADS.—(Figs. 7, 8). First, the thread must be properly made to the correct depth, lead, contour, and taper, and secondly, the joint axis must coincide as nearly as possible with the product axis. The best and most accurate type of thread is made on drill collars on a thread-milling machine (see Fig. 7). Here the thread elements are controlled by the hob and the complete spiral is generated by one revolution.

No matter how perfect the thread, if it is not aligned with the axis of the collar, rotation in the well sets up bending stresses that can twist a pin off rapidly. In addition to precautions in setting up the collar in the lathe, it is wise to check every joint by an optical system as shown in Fig. 8. Here accurately machined subs are screwed into the collar joints, one of which contains a telescope mounted on the axis of the threads and the other end holds a target in fixed relation to the joint. Misalignment can thus be held to ⅛ in. per 10 ft. of length.

No matter how well the threads are machined, some operators have trouble with galling and tearing of threads or shoulder. A final finishing operation, as done by National Supply Co., is to copper plate pin ends of all collars and subs by means of the brush plating arrangement (Fig. 9).

Fig. 6—(Above, left) The bore of drill collars is surveyed to prevent bore deviations and offset at the junction of bores from opposite ends of finished collars. Survey instrument is centered through slot in small building at left. A target, observed by surveyor's transit, is passed through the bore. Fig. 7—(Above, right) This hobbing machine threads drill-collar joints with greater accuracy than is possible by single-point tool threading

Fig. 8—(Below, left) Joint alignment is checked by an optical system. A machined sub with telescope mounted on the axis of the threads is screwed into one collar joint and the joint on the other end holds a target in fixed relation to the joint. Fig. 9—(Below, right) The pin ends of all drill collars and subs are copper plated, using a brush plating procedure



These two photographs show the "Audigage," portable thickness measurement instrument, in typical plant "checkup" applications. No test-drill holes are required, and the procedure permits the testing of more points than ordinarily possible

Ultrahigh-Frequency Sound Waves Measure Thickness of Metal From One Side

by Norman G. Branson*

INCREASING use is being made of an inspection tool utilizing ultrahigh-frequency sound waves to measure metal thickness from one side. A wide variety of test and inspection problems in refineries, processing plants, and piping installations are being solved.

This instrument, the "Audigage," measures metal wall thickness from one side, by determining the fundamental natural frequency of vibration of the wall. The natural frequency of a thickness vibration is essentially independent of other physical dimensions of the material. At the present time the instrument is being used by 35 oil refineries, as well as numerous other chemical-processing plants. These refineries represent approximately half of the total United States cracking capacity.

The instrument and all accessories are contained in a case 8½ by 9 by 11 in., and weighs 14 lb. Space for the accessories is provided in the instrument cover, which is attached to the instrument by means of a removable hinge. Power for the five electronic tubes is furnished by small batteries of a type normally used in portable radios.

*Branson Instruments, Inc., Joe's Hill Road, Danbury, Conn.

The instrument measures the thickness of steel over a range from ⅛ to 12 in. Accuracies within 2 per cent of the actual wall thickness can normally be obtained. The area for the standard flat quartz vibrator is 1 sq. in. Curved crystals are normally made with an area of ½ sq. in.

To illustrate the principle of operation, if a string having the same length as the thickness of a metal wall is shaken back and forth as shown in Fig. 1, the string will develop the shape shown at a certain frequency. Only one frequency, the fundamental frequency, will produce this condition for a certain length. By increasing the vibrating frequency, Fig. 2, two or more nodes may be added to the form the string will take. The frequencies at which the different nodes (harmonics) will form, is a multiple of the fundamental; thus, if the frequency of two adjacent harmonics is known, the fundamental frequency is found by obtaining the difference between the harmonics.

Knowing the frequency of the fundamental wave length, the thickness of the metal plate can be computed from the formula:

$$t = \frac{V}{2f}$$

Where

V = velocity of the wave (in in. per sec.)
t = thickness of plate (in.)
f = frequency of the fundamental wave length (cycles per sec.)

In the above illustration, the force producing the vibration can have various frequencies, but nodes will only form at the various harmonic frequencies of the string. When these nodes form, the vibrator and the string are said to be at a resonance condition.

In the application of the Audigage, a quartz crystal is the vibrator and the metal wall thickness is equivalent to the length of string. The wave motion, instead of up and down in the case of the string, is a compression wave in the metal.

To illustrate, Fig. 3 (a) shows the metal wall as a series of evenly spaced plates. Under the influence of the quartz crystal, the plates are pushed together and drawn apart, forming compression waves which travel through the plate. When resonance takes place, the metal plates are going back and forth with the same frequency as the quartz crystal. Fig. 3 (b) illustrates a resonance condition of the first harmonic, with the quartz crystal compressing the plates at the surface.

The Audigage excites a quartz crystal to vibrate at variable frequencies. When the crystal is caused to vibrate at a frequency which corresponds to a natural frequency of thickness vibration in the metal plate, the instrument will produce an audible tone in the headphones. From the frequencies of two adjacent harmonics, the fundamental frequency is found by subtraction and the thickness of the plate is determined on a concentric conversion scale.

Characteristics of Supersonic Resonance

The average metal thickness for an area directly under the crystal is not measured. Rather, resonance indications are obtained for the different thickness components which lie directly under the crystal. Therefore, if the thickness is uniform, i.e., both surfaces relatively smooth and parallel, the thickness resonance indications will be very strong and sharp. If there is lack of parallelism or if there is rough pitting of the metal surfaces, thickness indications which are obtained will be weakened and broadened in proportion to the amount of thickness variation under the crystal. Excessive thickness vari-

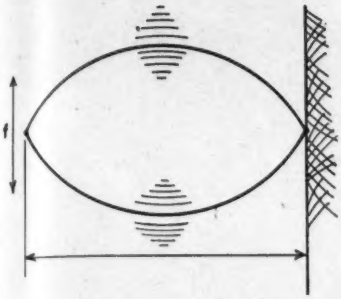
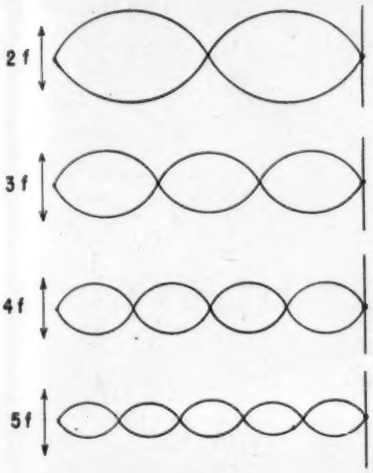


Fig. 1—(Above) A string of the same thickness as a given metal wall will develop this shape at a certain frequency.

Fig. 2—(Below) Two or more nodes may be added to the form of the string by increasing the vibrating frequency



ations will make it impossible to obtain resonance indications. The maximum peak to valley depth of pitting in the reflecting (opposite) surface before resonance indications will "blank out" is approximately 1/32 in.

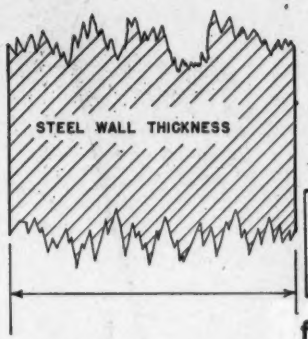
The supersonic resonance principle is applicable to the measurement of only those materials which are relatively good conductors of high-frequency sound waves. Nearly all forged, rolled, or pressed metals are good conductors of supersonic waves. Therefore, the instrument will measure the actual metal wall thickness of a pipe or tank without also measuring coke, scale, or liquids which may be in intimate contact with the opposite surface. Due to various damping effects which these materials may have on metals, when the two materials are in intimate contact, the character of the sound of the audible thickness resonance indications will be affected. This effect will often enable a skilled operator to predict the condition of a hidden surface. In the case of stainless steel or glass-bonded linings in steel vessels, a reading of the total wall thickness will be obtained.

Cast materials, such as cast iron and cast bronze, are too porous to provide good transmission of supersonic waves. For this reason, it is usually impossible to obtain thickness readings on cast materials.

Supersonic waves will not pass through any discontinuity of a material, such as laminations and slag inclusions, but will be reflected at the line of discontinuity. Therefore, if two metal plates are in intimate mechanical contact but not bonded, thickness readings will be obtained for only the metal plate to which the crystal is applied.

The velocity of supersonic waves in metals is essentially independent of temperature. For steel, the velocity of sound is practically constant regardless of the chemical composition or heat treatment. These factors contribute to the simplicity of making thickness measurements on all kinds of steel, as no corrections are necessary to provide accurate and reliable readings.

Since scale is a very poor conductor



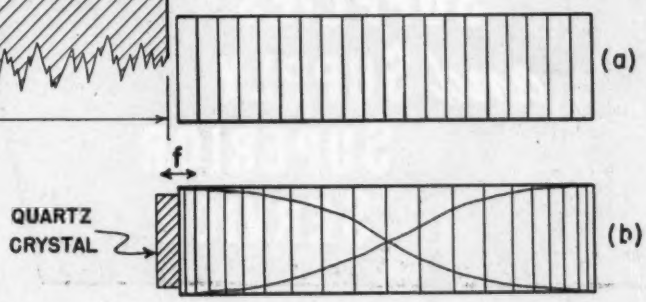


Fig. 3—(Below) Compression waves in a metal plate, analogous to string vibration in Fig. 2

TABLE 1—MEASUREMENTS MADE BY GENERAL PETROLEUM CORP., VERNON, CALIF.

(Data quoted from report by R. W. Wiese)

Reading No.	No. 1 boiler stack — Audigage measurement	Caliper measurement
1	.248	....
2	.220	.225
3	.220	.220
4	.238	....
5	.279	.275
6	.201	....
7	.225	....

of supersonic waves, it is necessary to remove any scale, except very thin coatings, from the metal surface at the point where the crystal is to be applied. However, it is unnecessary to remove ordinary mill scale. Thickness readings can usually be obtained without removing paint, if the paint is well bonded to the metal. No thickness indications are obtained if the crystal is improperly applied.

No corrections are required for the shape of the object or because of edge effects. The same calibration is used for all pipe sizes and tank diameters as is used for a flat plate. A reading obtained in the middle of a large plate, of any area, will be essentially the same as the reading obtained on a 1-sq.-in. area having the same thickness.

Although the thickness readings are independent of the area of crystal contact, the actual strength and, to some extent, the sharpness of thickness resonance indications does depend on the area of effective crystal contact. When a flat crystal is used, the strongest signals will be obtained on flat plates. Small-diameter pipes have a very small contact area with a flat crystal. By using high amplification, audible thickness indications can usually be obtained by using a flat crystal to measure pipes with a diameter as small as 2 in. For measurements on small pipes with diameters of less than 4 in., substantial gain in sensitivity can be ob-

TABLE 2—MEASUREMENTS MADE BY PHILLIPS PETROLEUM CO.

Description—	Audigage measurement	Caliper measurement	Difference
4-in. pipe with ⅛-in. coating of carbon on inside	.298	.305	.007
Structural steel	.350	.360	.01
6-ft. diameter tank	.96	1-in. nominal	....
12-in. line	.215	.25 nominal	....
8-in. suction line	.245	.25 nominal	....
27-chrome tube containing catalyst and section of file	.19	.19	0
6-in. bend, gas oil line	.466	.46	.006
6-in. spool, gas oil line	.458	.44	.018
6-in. spool, gas oil line	.353	.37	.017
6-in. bend, gas oil line	.435	.437	.002
4-in. spool, discharge line	.340	.350	.01
Bend in discharge line	.455	.460	.005
6-in. bend, suction line	.455	.437	.018
6-in. bend, suction line	.400	.406	.006
4-in. bend, discharge line	.445	.440	.005

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tained by grinding crystals to fit the curvature of the pipe. This improved sensitivity will often make it possible to obtain thickness readings on small pipes, which could not be measured with a flat crystal because of rough, pitted internal surfaces. The measurements listed on Tables 1 to 3 were made under actual field conditions by using flat crystals only.

Application and Examples of Performance

The instrument is particularly useful for the gaging of fractionating towers. When such equipment is shut down for inspection, it is frequently preferable to make measurements from the inside of the tower. In the case of insulated towers, this method will eliminate the necessity of cutting and replacing insulation. Also, the erection of scaffolding can often be eliminated.

Extensive uses for the instrument are found in the inspection of pipes. It permits the rapid location and gaging of localized thinning due to erosion at bends and near inlets. Measurements can be made quickly at many points along a pipe to determine if there is erosion due to eddies in the flow. The effect of corrosion and erosion which produces eccentric thinning is readily determined. Under such conditions measurements can be obtained for both the minimum and maximum pipe thickness. In the case of pipes which are lined on the inside with coke or scale, measurements are obtained for the actual steel wall thickness.

The use of the instrument to measure filled tanks and storage vessels permits the determination of wall thickness without the necessity of emptying the vessel. There are no errors in wall-thickness measurements due to liquid inside the tank. In some cases, the cost of inspecting the wall thickness of such tanks, by "drilling and plugging" methods, would be prohibitive.

One example is the case of Ethyl-fluid weigh tanks which are used for "weighing out" concentrated ethyl fluid in the blending operation. To determine the wall thickness of these tanks by drilling and plugging would require that the tanks be thoroughly cleaned to remove all trace of tetra-ethyl lead which would be dangerous to workmen. The cost of such a method would be so great that it would be less expensive to replace the old tank with a new one. A non-destructive method of measuring tank-wall thickness was required, which would provide reliable measurements of steel wall thickness independent of the effect of lead-compound deposits which build up on the inner surface and also independent of the effect of Ethyl fluid in the tank. Tests were made with the Audigage on a tank which had been taken out of service, and the instrument was found to meet the necessary requirements. The instrument was then used to inspect many of the oldest tanks which are in service throughout the United States. The information thus obtained makes it possible to continue to operate the tanks for the maximum time under known safe conditions.

Data obtained with the Audigage from measurements which have been made on many practical applications in the field are tabulated in Tables 1 to 3. Nondestructive thickness testing with the instrument will eliminate 80 to 90 per cent of drilling and plugging normally performed in typical refinery applications. Accurate and reliable surveys of the condition of equipment, in and out of service, can be obtained rapidly. For a given number of man-hours devoted to inspection, many more points can be tested than would be possible by older methods. The result is more thorough inspection of equipment at reduced cost, greater safety to personnel, and reduction of plant shutdown time.

Reference

1. Erwin, Wesley S.: "A Supersonic Contact Instrument for Thickness Measurement." Paper presented at S.A.E. meeting at Los Angeles, October 1944.

For another article on this subject, the reader is referred to "Gamma Ray and Supersonic Equipment-Inspection Methods Used in Continental Oil's Eight Refineries," by Leigh S. McCaslin, Jr., Journal issue of October 18, 1947, page 100.

TABLE 3—MEASUREMENTS MADE BY SHELL OIL CO., INC., NORCO, LA., REFINERY
(Data are excerpts from report by H. A. Le Blanc)

(A) Pressure Vessels in Operation

Description—	Audigage thickness	Last caliper thickness	Difference
Pressure dist. rundown tank, head	.41	.41	0
Caustic regenerator column, head	.69	.70	0.01
P.D. treater wash tower, skirt	.52	.52	0
P.D. treater wash tower, 6-in. nozzle	.47	.48	0.01
Poly. depropanizer reflux accumulator	.68	.71	0.03
Poly. plant charge surge tank, shell	.77	.76	0.01
Poly. rerun reflux accumulator, shell	.48	.50	0.02
Alky. plant acid blow case, head	.53	.52	0.01
Pressure distillate reflux accumulator	.77	.76	0.01
Propane dryer, top head	.61	.63	0.02
Propane dryer, shell	.60	.61	0.01

(B) Equipment Out of Service

Description—	Audigage thickness	Caliper thickness	Difference
Butane storage Hortonsphere:			
Point No. 1	.60	.61	0.01
Point No. 2	.56	.56	0
Point No. 3	.60	.61	0.01
Point No. 4	.55	.56	0.01
Point No. 5	.61	.63	0.02
Point No. 6	.59	.59	0
Point No. 7	.60	.59	0.01
Top head plate	.60	.61	0.01
¾-in. o.d. steel tubing with ½-in. coke deposit	*.50	*.50	0
4-in. o.d. brass pipe	.25	.25	0
8-in. o.d. No. 1 steel surge bend	.78	.77	0.01
8-in. o.d. No. 3 steel surge bend	.57	.58	0.01
8-in. o.d. Dubbs-steel vapor wing bend	.38	.36	0.02
3-in. o.d. Dubbs-residue bend, steel	.30	.28	0.02
Heat exchanger shell:			
Point (1)	.38	.35	0.03
Point (2)	.39	.40	0.01
Point (3)	.31	.32	0.01
Gasoline storage tank	.24	.23	0.01

*Thickness measurement was made with Audigage without removing coke. Coke was then removed to permit measurement of steel wall thickness with calipers. A total of 71 different Audigage thickness readings which were checked by caliper measurements are listed in Le Blanc's report. The average difference between caliper measurements and Audigage readings is less than 0.01 in. with a maximum difference of 0.03 in.

BOOKS

POLYMERIZATION OF ACETYLENE TO CYCLOOCTANE. By Karl Kammermeyer. Published by Hobart Publishing Co., Box 4127 Chevy Chase Br., Washington 15. 118 pp. $17.50.

This is a "PB" report available from the office of Technical Services, U. S. Department of Commerce, but the 40 pages of German text are not translated. The translated section is devoted to German patents and patent applications and is important to technologists. The translated material includes: process for preparation of cyclic polyolefins; process for preparation of cycloparaffins; process for preparation of phenylactaldehyde or beta-phenyl-alpha, alpha-ethylidenedisters, process for dimerization of cyclooctatetraene; preparation of additional compounds of cyclooctatetraene; process for preparation of cyclooctene; preparation of a hydrocarbon; high-molecular-weight unsaturated hydrocarbons, and many others.

WATER WELL HANDBOOK. By Keith E. Anderson. Published by Missouri Water Well Drillers Association, Box 250, Rollo, Mo. 200 pp. $1.50.

Most drillers, engineers, and geologists working with water wells have occasion frequently to refer to the charts, tables, and other data which are scattered throughout many books and catalogs. This handbook has been prepared with the view of bringing much of this information together. In its compilation and attempt has been made to gather only the information most frequently referred to by persons working with ground-water supplies. It was necessary, in many cases, to condense or abbreviate some of the data.

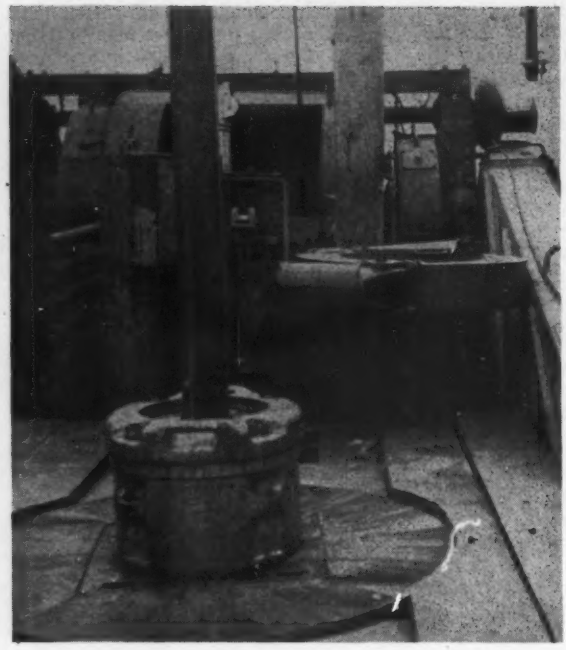


Fig. 1—Latest development in power slips shown in stowed position on rig floor (center background). Located at this point, slips are completely out of the way during drilling operations

Fig. 2—(Below, left) Adapter ring in place in rotary table. Purpose of the adapter ring is to guide toes of slips into bowl when setting. This photograph also shows the slips being swung into operating position. The door has been removed from the lifting ring preparatory to swinging ring around drill pipe

Fig. 3—(Below, right) Slips in position (with door replaced) for running or pulling drill pipe. It will be noted that drill pipe is off-center of rotary; however, driller experienced no difficulty in setting slips. Slip fingers enable slips to grasp pipe when pipe is off-center

New

POWER SLIPS

Increase Drilling Efficiency

by Ed Short

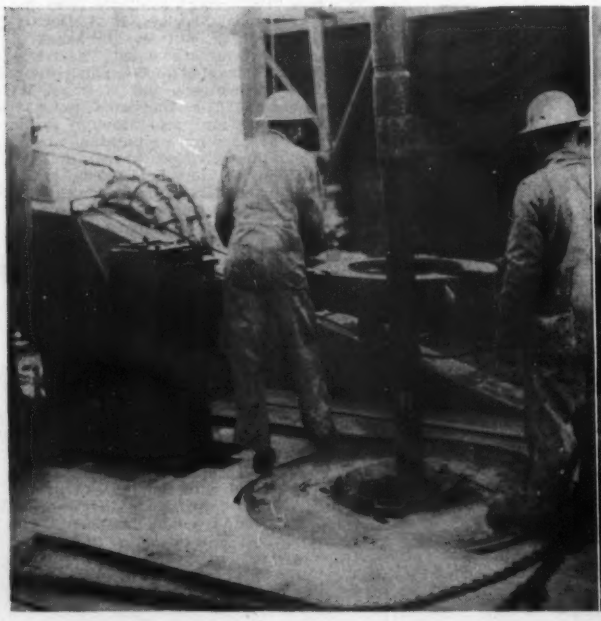
THE latest type of power slips installed on the Gulf Coast have a number of design features which, according to many field men, should result in a rather widespread adoption as part of standard equipment for a rotary-drilling rig.

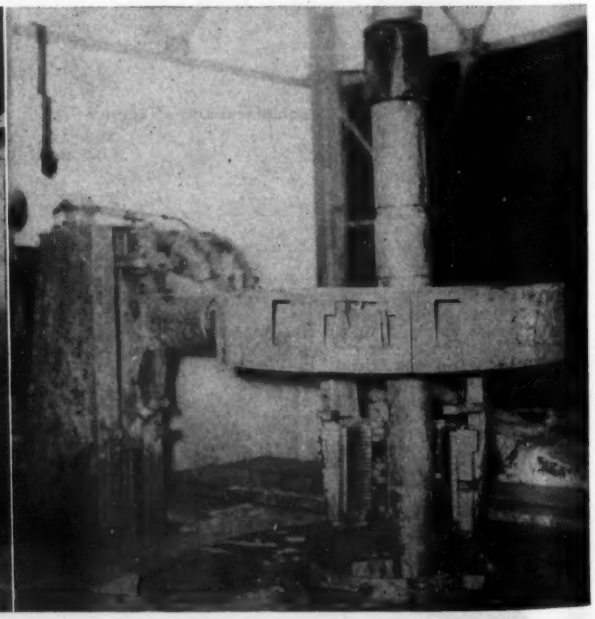
One of the most recent installations of the new power slips was made on a General Crude Oil Co. drilling rig in Esperson Dome field near Houston. The accompanying photographs, illustrating the manner in which these power slips function, were taken on this rig.

Stowed completely out of the way while not in use, these power slips are swung into operating position by one man in less time and with less effort than is required to put on a set of tongs. When around pipe, slips will pass protectors, tool joints, and any other equipment on the drill string which will pass through the rotary opening.

The driller operates the slips by means of a foot-actuated control valve which may be located near the brake at a point of convenience. The slips are lifted by means of a cylinder located inside the post. Air pressure on this cylinder actuates a roller-guided lifting bracket to which is attached the slip-lifting ring arm.

When the foot-control valve is pressed to a down position, air is released from the air cylinder through oversized relief valves. This causes the slips to set in less than 1 minute. However, the speed of setting may be ad-





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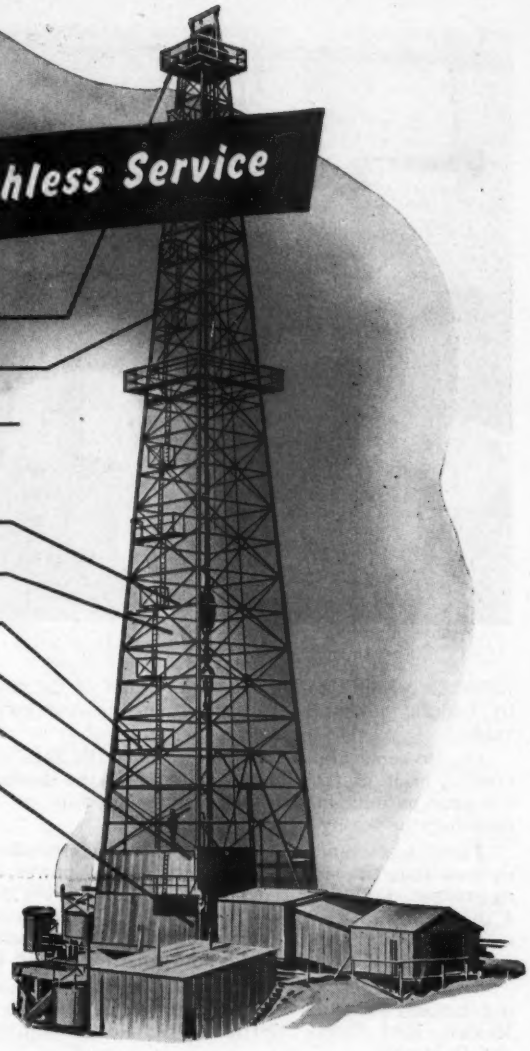

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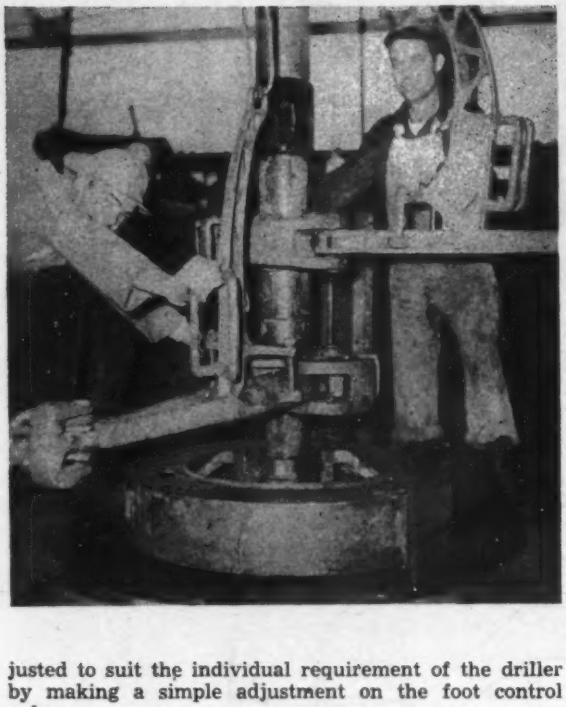


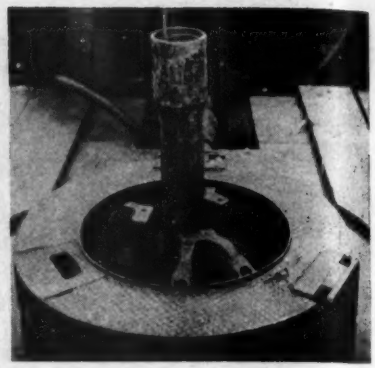


Fig. 4—(Left) Slips shown in engaged position—in this instance, during a breaking-out operation. This cut brings out the durable handle posts (extending above the lifting ring) which have been designed to withstand the sudden impact which results when elevators are inadvertently set too low on top of slips. This photograph also shows the low position at which tool joints may be set in respect to the rotary, thereby permitting most advantageous position for tong operation

Fig. 5—(Above) Closeup view of handle posts which shows that the rollers on ends of slip handles do not contact the lifting ring when in lowered or engaged position. This particular arrangement eliminates wear of rollers and lifting ring when rotating to spin out. On the outer edge of the ring (shown at right in photograph) is the alternate location of bracket which permits attaching to the arm of lifting mechanism so that slips may be stowed, if desired, on the opposite side

Fig. 6—(Below, left) Spinup chain being placed to makeup kelly. This cut shows the nonskid plate surface of the lifting ring which insures safe footing for men during makeup and breakout operations. Lifting post is in left background

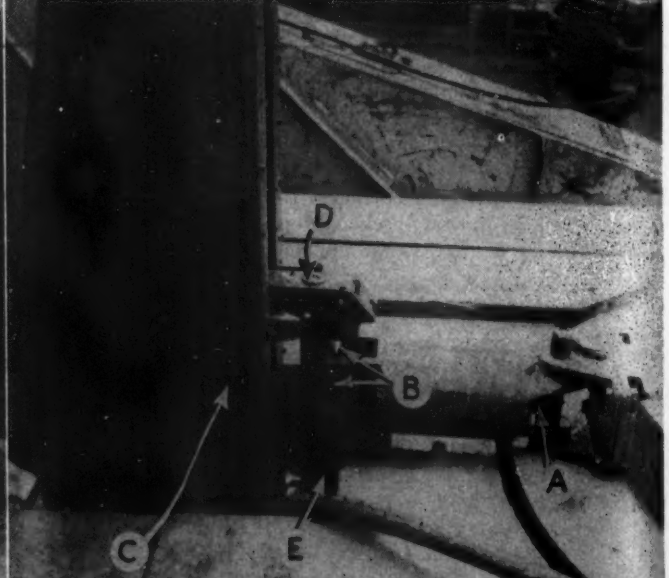
Fig. 7—(Below, right) Closeup of lower part of lifting post and arm. (A) Bolt for adjusting telescoping arm to desired position. (B) Hinge pin to permit adjustment to suit different height rotaries. (C) Opening in post shell is a second adjusting bolt which permits accurate positioning of the lifting ring with respect to the slip arms. (D) Pivot about which adjustment may be made to position the lifting ring laterally. (E) Shear pin which permits the ring to drop down under unusually severe accidental loads

justed to suit the individual requirement of the driller by making a simple adjustment on the foot control valve.

Should some unusual accident render the slips inoperative, or if the air supply should fail, the design of the ring permits instant removal of the slips so that they may be set by hand.

Field tests under ordinary operating conditions showed that the use of this new type of power slip, as compared with the hand-slip method, saves from 4 to 6 minutes per 1,000 ft. of depth. When drilling at a depth of 10,000 ft., for example, the time saving ranges from 40 minutes to 1 hour on each round trip.

These Mission power slips have been installed during the past 6 months on rigs operating in South Texas, Mexico, East Texas, North Texas, North Louisiana, and California.



QUESTIONS on TECHNOLOGY

by W. L. Nelson

Consulting Engineer

Chemicals From Petroleum

What companies are making alcohol from petroleum?—V. A.

A complete list of the companies that make ethyl alcohol (ethanol) from petroleum cannot be given but among the companies listed below are some that have stated that they make alcohol from petroleum. Among these are the Standard Alcohol Co. (Standard Oil Co. of New Jersey) and the Shell Chemical Division. Chemical companies such as Carbide & Carbon Corp. and E. I. du Pont de Nemours & Co., also produce alcohol from petroleum sources.

The following (Table 1) companies and plants are manufacturing ethylene or are building plants for large productions of ethylene (Smoley, Torry and Kniel, open-panel discussion at A.C.S. meeting, Lafayette, La.). This table does not include ethylene used within chemical plants for hydration to alcohol.

TABLE 1—PRODUCTION OF ETHYLENE FROM PETROLEUM AND NATURAL GAS

Company or plant—	Ethylene production approx. lb. per day
Carbide & Carbon, South Charleston, Whiting, and Texas City	900,000
Dow Chemical Co., Midland, Mich., and Velasco, Tex.	230,000
Du Pont, Orange, Tex.	*150,000
Ethyl Corp., Baton Rouge	50,000
Ethyl Corp., Baton Rouge	*150,000
Jefferson Chemical Co., Port Neches, Tex.	*175,000
Koppers Co., Kobuta, Pa.	40,000
Monsanto Chemical Co., Texas City, Tex.	175,000
Shell Chemical Co., Houston	*325,000
Southern Calif. Gas Co., Los Angeles	†800,000
Standard Oil Co. of Louisiana, Baton Rouge	275,000
Others	100,000
Total	3,370,000

*Under construction. †Recently shut down.

According to Synthetic Organic Chemicals, U. S. Production and Sales (1945 and earlier issues), Report 157, second series of the U. S. Tariff Commission, production of chemicals from petroleum in 1945 was 3,310,021,000 lb. plus about 98,521,000 gal. of toluene.

Table 2 is an attempt to show the petroleum chemicals manufactured by various companies. In large part it was taken from "Synthetic Organic Chemicals" (U. S. Tariff Commission) but other sources were also utilized. It is possible that some of the chemicals listed are not made from petroleum or natural gas and, of course, part of some so-called petroleum chemicals, such as the lead in tetraethyl lead or the chlorine in methyl chlorine, must come from other sources.

TABLE 2—SOME OF THE CHEMICALS MANUFACTURED FROM PETROLEUM AND NATURAL GAS (Mainly 1945)

Ashland Oil & Refining Co.
Butane.

Atlantic Refining Co.
Diisopropyl benzene sulfonic acid; polyalkyl benzene sulfonic acid, sodium salt; petroleum sulfonate, barium salt; petroleum sulfonate, calcium salt; petroleum sulfonate, sodium salt.

Carbide & Chemical Corp.
Methane, ethane, ethylene, propane, propylene, 1-3-butadiene, butane, isobutane, heptane, polystyrene-type resins, polyethylene, polyvinyl chloride-acetate, polyvinyl alcohol, polyethylene glycol, butylamine, mono; acetone, acetic acid, acetic anhydride, ethanol, ethylene glycol, diethylene glycol, ethyl formate, isopropanolamine, isopropyl acetate, methyl isobutyl ketone, propylene glycol, propylene chlorohydrin.

Celanese Corp.
Acetic acid, acetone, methanol, formaldehyde, acetaldehyde, propionaldehyde.

Cities Service Refining Co.
1,3-butadiene, methyl-acetone-acetal, acetaldehyde, methane, formaldehyde.

Commercial Solvent, Inc.
Nitroethane, nitromethane, 1-nitropropane, 2-nitropropane.

Continental Oil Co.
Nonyl naphthalene, nonene, xylene, toluene (aviation).

Dow Chemical Co.
Ethylene, propylene, 1,3-butadiene, ethylene glycol, carbon tetrachloride, perchlorethylene, styrene, polystyrene, diethylene glycol, propylene glycol.

Du Pont de Nemours, E. I., & Co., Inc.
Cyclohexane, cyclohexanol, cyclohexylamine, adipic acid, styrene, amyl alcohols, amyl acetates, isobutyl acetate, pentachloroethane, vinyltrichloride, isobutyraldehyde, isobutyric acid, isopropyl ether, propylene, vinyl acetate, petroleum alkylsulfonate, sodium salts.

Ethyl Corp.
Ethylene dibromide.

Gulf Oil Corp.
Naphthenic acid.

Humble Oil & Refining Co.
Xylene, 1-3-butadiene, 1 and 2-butenes, isobutylene, petroleum sulfonate, petroleum sulfonate, ammonia salt.

Jefferson Chemical Co.
Ethylene glycol, ethylene.

Lion Oil Co.
Butadiene, sulfur.

Magnolia Petroleum Co.
Toluene (aviation), cresylic acid.

Monsanto Chemical Co.
Ethylene, stryene, cyclohexanol, cyclohexylamine.

Neches Butane Products Co.
1-3-Butadiene.

Nuodex Products Co., Inc.
Naphthenate, chromium; naphthenate, cobalt; naphthenate, iron; naphthenate, lead; naphthenate, manganese; naphthenate, mercury.

Ohio Chemical & Manufacturing Co.
Methane, ethane, propane, propylene, n-butane, i-butane, butadiene, trimethylene chlorohydrin, triethylene glycol.

Pan American Refining Corp.
Toluene, toluene (aviation), xylene.

Phillips Petroleum Co.
Propane, propylene, 1,3-butadiene, n-butane, 1 and 2-butene, isobutylene, n-pentane, pentene-1, pentene-2, isoheptane, cyclohexane, dicyclopentadiene, alkyl mercaptans, dialkyl disulfides, methane, ethane, isobutane.

Isopentane, 2,3-dimethylbutane, ethylene, propylene, 2-methylbutadiene, ethyl benzene, 2,2-dimethylbutane, 2-methylpentane, 3-methylpentane, isohexanes, n-hexane, 2,4-dimethylpentane, 2,3-dimethylpentane, isoheptanes, n-heptane, 2,2,4-trimethylpentane, 2,2,5-trimethylhexane, cyclopentane, methyl cyclopentane.

Pure Oil Co.
Xylene, propane, n-butane, 1 and 2-butene, isobutane, isobutylene, pentanes, petroleum resins.

Richfield Oil Corp.
Naphthenic acids.

Sharples Chemicals, Inc.
Amylenes, amylphenol, amylnaphthalenes, sec-amylphenol, p-tert-amylphenol, 2,4-di-sec-amylphenol, 2,4-di-tert-amylphenol, dichloropentanes, diamylnaphthalene, polyamylnaphthalene, amylamines, mono, di, and tri; butylamines, mono, di, and tri; ethylamines, mono, di and tri.

Amyl acetates, primary, mixed isomers; n-butyl carbinol, 2-methyl butanol-1, methylpropyl carbinol, diethyl carbinol, 3-methyl butanol-1, 2-methyl butanol-2, amyl ether, amyl mercaptan, diamyl sulfide, dibutylaminoethanol, diethylaminoethanol, amyl chlorides, mixed.

Shell Union Oil Corp. Companies
1,3-Butadiene, allyl alcohol, methylethyl carbinol, trimethyl carbinol, 1,3-dichloro-2-hydroxypropane, allyl chloride, isopropanol, methylethyl ketone, methyl isobutyl ketone, isopropyl ether, acetone.

Glycerol, mesityl oxide, ethanol, methallyl alcohol, methallyl chloride, propylene dichloride, diacetone alcohol, sec. butyl alcohol, tert. butyl alcohol, glycerol chlorohydrin, epichlorohydrin, toluene, cresylic acid, n-butane, petroleum sulfonate.

Sinclair Refining Companies
Toluene; petroleum sulfonate, ammonium salt (oil); petroleum sulfonate, calcium salt (oil); petroleum sulfonate, sodium salt (oil); 1-3-butadiene.

Skelly Oil Co.
Ethyl mercaptan, alkyl mercaptans.

Sonneborn, L., Sons, Inc.
Petroleum sulfonate, sodium salt.

Sonoco Products Co.
Phenol-formaldehyde.

Southern California Gas Co.
Xylene, butadiene.

Standard Oil Co. of California
Toluene, toluene (aviation), cresylic acid, naphthenic acid, xylene, 1,3-butadiene, polybutene, phthalic anhydride, chloroparaffin, sulfonated naphthenic acid, sodium salt; petroleum sulfonate, sodium salt.

Standard Oil Co. of Indiana
Toluene, toluene (aviation), cresylic acid, xylene, petroleum sulfonate, aluminum salt (acid); petroleum sulfonate, sodium salt (acid, oil).

Standard Oil Co. of New Jersey Companies
Naphthenic acid, diisobutylene, polybutadiene resin T 132, purbunan, vistanex, petroleum sulfonate (oil), methylethyl carbinol, propylene, butylenes, isobutene, triisobutylene, chloroparaffin, isopropyl acetate, isopropanol.

Ethylene, propylene, 1,3-butadiene, 1 and 2-butene, ethyl alcohol, isoprene, vistanex, ethyl ether, isopropyl ether, polybutylene GR-1 type, petroleum sulfonates, sodium salt; dioctanyl disulfide, barium isooctylphenol sulfide, barium isooctylphenol stearol, sulfurized chlorokerosine, amyl alcohol, sec. butyl alcohol, sec. butyl acetate, methyl propyl ketone.

Sun Oil Co.
Naphthenic acid, propane, n-butane, isobutane, isopentane, petroleum sulfonate, sodium salt (oil); butadiene.

Taylor Refining Co.
Butadiene, n-butane, butenes, isobutene.

The Texas Co.
Benzene, toluene, naphthenic acid, 1 and 2-butene, petroleum sulfonate, sodium salt.

Union Oil Co. of California
Toluene, naphthenic acid, methyl mercaptan, sulfonated naphthenic acid, sodium salt.

EFFECT OF WATER INJECTION IN GAS DRIVE

by D. E. Menzie*

SECONDARY oil recovery by air-gas drive has been used in some Pennsylvania oil fields for a quarter of a century or more. During this time much scientific knowledge has been gained and put to use for increasing oil production; but even today there remains the great challenge for all oil producers to reduce the vast quantities of oil which by present day methods are destined to remain as residual oil in the sands and to produce the amount of oil which can be obtained with a minimum amount of effort and cost. In this article a brief dicussion is presented of the beneficial effects of water injections during an air-gas drive on long cores. Laboratory data and curves show the increased oil recovery as a result of these injections. The article also attempts to show the added benefit of reduced air-oil ratios which result from water injections.

Previous Investigations on Water Injection in Air-Gas Drives

Many investigators have recognized the importance of the role of connate water in secondary recovery of petroleum[1,2,3]. This role is especially important in the air-gas regions for the margin of profit of a lease may be regulated to a great extent by the amount and distribution of the connate water. In a paper by Dickey and Bossler[4], it is pointed out that the saturations of liquids in the reservoir will be the controlling factor in the movement of air. It has been further stated that the lack of fluid saturation in a formation is responsible to a great extent for the excessive by-passing of air during a drive[5]. Krutter[6] found that during an air drive the greatest amount of oil, expressed in terms of the per cent of original oil in the sand, is recovered when 30 per cent connate water is present in the sand. In a paper by Yuster and Day[8] some laboratory experiments were presented to show how water may substitute in part for the residual oil in the formation. These experiments led to a study which was reported at the tenth annual secondary recovery conference last year[7]. This paper will present some advantages of water injections during an air drive as found by the laboratory studies performed. A short discussion will be made of the possibilities of water injections being used in the field and their advantage with respect to increased oil recoveries with reduce damounts of air required.

Core Properties and Methods

Core R-9, which is the first core used in these experiments, was obtained from a horizontally drilled sec-

*Division of Petroleum and Natural Gas Engineering, The Pennsylvania State College, State College, Pennsylvania. Presented at the Eleventh Annual Secondary Recovery Conference held at The Pennsylvania State College on October 31 and November 1, 1947.

Summary of Experiments

The experiments covered in this paper show:

1. Increased oil production by water injection in a Cow Run core using a close-cut oil.

2. Approximately the same increase in production when using a Venango crude oil.

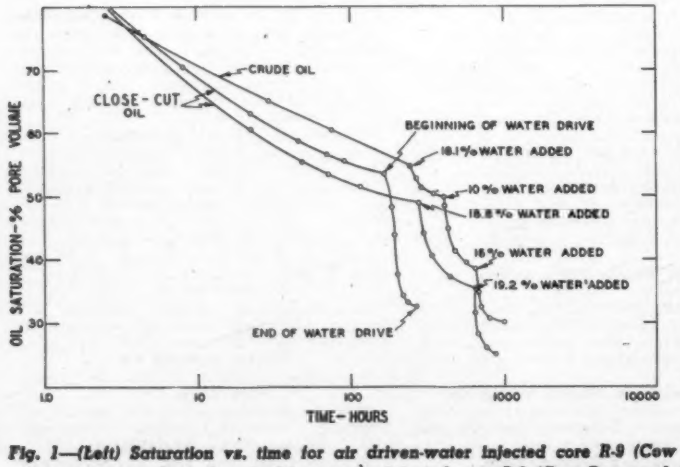
3. The additional oil recovered by water injections was greater when slugs of water were injected than when a regular water drive was imposed on the sand.

4. Reduced air volumes were required to recover this additional oil as was shown by reduced gas volumes and gas-oil ratios.

5. Water injections help to reduce the amounts of air which are blown through the high permeability formations.

6. Increased oil recoveries resulted from water injections even when the connate water saturation was above the irreducible minimum water saturation.

7. Similar results as given above for a Cow Run core have been observed in tests with a Venango core.



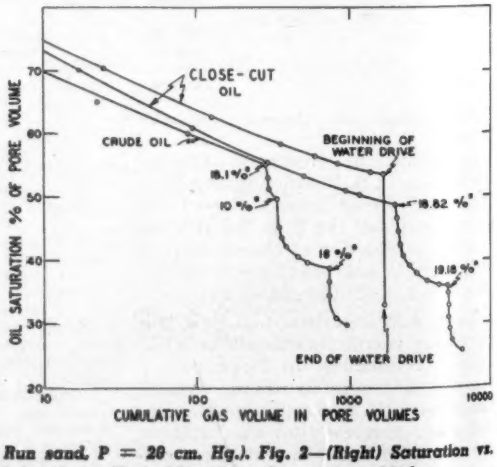


*Fig. 1—(Left) Saturation vs. time for air driven-water injected core R-9 (Cow Run sand, P = 20 cm. Hg.). Fig. 2—(Right) Saturation vs. gas volume for air driven-water injected core R-9 (Cow Run sand, P = 20 cm. Hg.). *Signifies when water added*

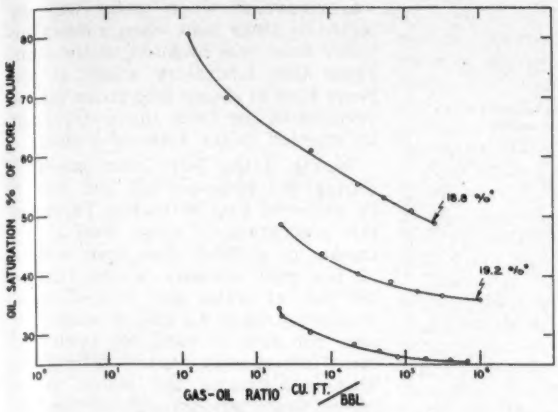
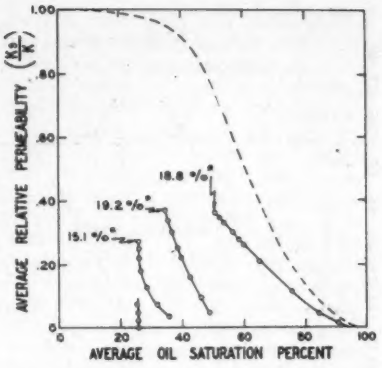


*Fig. 3—(Left) Saturation vs. gas-oil ratio for air driven-water injected Core R-9 (Cow Run sand, P = 20 cm. Hg.) *Signifies when water added. Fig. 4—(Right) Saturation vs. relative permeability for air driven-water injected core R-9 (Cow Run sand, P = 20 cm. Hg.). *Signifies when water added*



tion of the Cow Run sand in Ohio. The core is about 3 ft. long, 2¼ in. in diameter, and was coated with about 100 layers of colorless metal finishing laquer. The average dry-air permeability of the core was found to be approximately 800 millidarcies. A small plug was drilled from the input end of the long core and was used to obtain the capillary pressure curve which will be discussed later.

Core A-1 was obtained from the Franklin mine project. It is a Venango sand core approximately 4 ft. long and about 2 in. in diameter. This core was mounted for these experiments with a layer of lucite. The core was then divided into several sections to facilitate handling and to reduce the time required for each run. Three sections have been denoted as A-1-A, A-1-B, A-1-C, and pertinent properties of each are given in Table 1. The fourth section of core A-1 was used to obtain a plug from which the capillary pressure curve for this core was made.

In each experiment the cores were extracted, dried, and saturated with the fluids used in the tests. When saturating a core with liquid a vacuum was drawn on one end of the core and a pressure used to force the liquid into the core. After each run, the core was extracted and returned to the original dry weight. All saturation percentages are based on total pore volume of the core.

Water Injections in the Cow Run Sand

A series of experiments has been performed on a long core of the Cow Run sand (Table 1) in which alternate air drives and water injections show their effects on cores 100 per cent saturated with close-cut Pennsylvanian oil and degassed Venango crude. Fig. 1 is a graph of oil saturations in per cent of the pore volume of the core plotted against time of air drive in hours. The core had been 100 per cent saturated with a close cut oil of 0.805 specific gravity and 2.3 centipoises viscosity. A 20-cm. mercury air drive was imposed on the core. This amounts to 1.29 lb. sq. in. per foot pressure gradient across the core. At the finish of the first air drive the saturation of the core had been reduced to 49 per cent oil. At this point in the air drive the core was considered produced to an economic limit.

TABLE 1—PROPERTIES OF CORES

Core	Type of sand	Length inches	Dia. inches	Perm. mds.	Porosity per cent	Pore vol. cc.	Remarks
R-9	Cow Run	35.9	2.20	19.4	19.4	480	Coated with lacquer
A-1-A ...	Venango	4.06	2.05	8.9	8.9	15.7	Coated with lucite
A-1-B ...	Venango	4.29	2.05	9.2	9.2	21.3	Coated with lucite
A-1-C ...	Venango	14.76	2.05	9.3	9.3	75.9	Coated with lucite

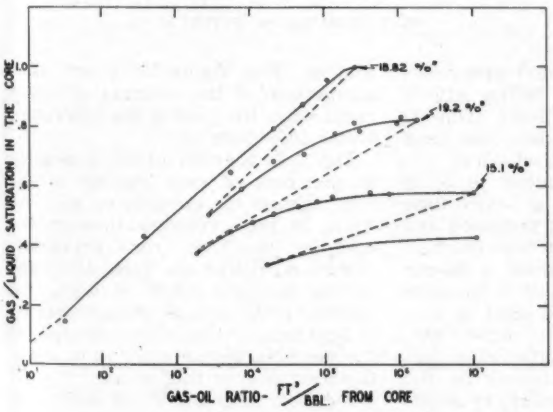
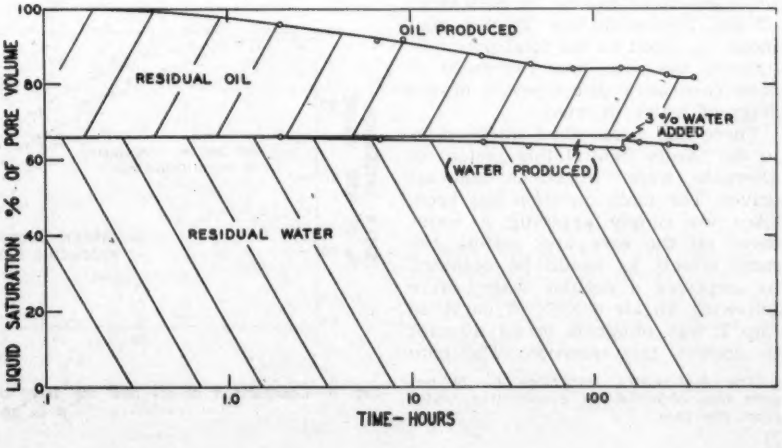
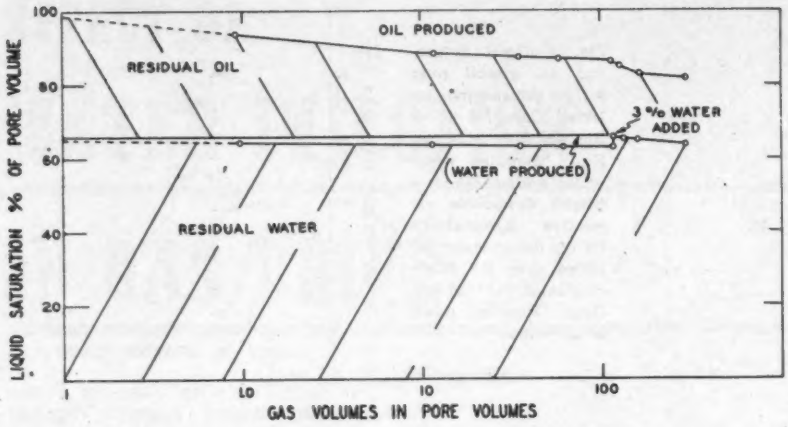


*Fig. 5—(Left) Gas-liquid saturation vs. gas oil ratio for air driven-water injected core R-9 (Cow Run sand, P = 20 cm. Hg.). *Signifies when water added.*

Fig. 6—(Below) Water and oil saturation vs. time for air driven-water injected core R-9 (Cow Run sand, P = 20 cm. Hg.)

To study the effects of water injections a slug of water equal to 18.8 per cent of the pore volume of the core was injected into the input end of the core. This water was forced into the core by applying the same amount of air pressure to the water slug as was used in the previous air drive. After this amount of water was injected, the core was allowed to stand for a period of time while the injected water distributed itself throughout the core. A second air





drive of 20 cm. mercury was then applied to the core, and as can be seen by the curve in Fig. 1 the core was reduced to 35.5 per cent oil saturation. This is an added 13.5 per cent of oil recovered by the injection of the slug of water. A second water injection of 19.2 per cent was added when the core was considered driven to an economic limit. A 20-cm. mercury air drive was repeated on the core and approximately 10 per cent more oil recovered. A third water injection was performed and another air drive was imposed on this core, but only a trace of oil and some water was produced.

Fig. 1 also shows a similar run on the same core except that a Venango crude oil (0.82 specific gravity and 6.5 centipoises viscosity) was used during the experiments. The core was saturated with 85 per cent crude oil and 15 per cent water.* A 20-cm. mercury air drive reduced the oil saturation to 55 per cent. An 18.1 per cent slug of water was added and the 20-cm. mercury air drive was repeated with a beneficial result of 5 per cent more oil being obtained. This procedure was repeated with a 10 per cent and a 16 per cent slug of water which resulted in 11 per cent and 9 per cent more oil being produced from the core. By a comparison of the close-cut oil curve of Fig. 1 and the crude-oil curve it can be seen that the beneficial effect of water injection holds true for both types of oil. Approximately 25 per cent more oil, based on the total pore volume of the core, was recovered in each case as a direct result of the slugs of water injected.

There has been some question as to the theory behind this system of alternate water injections and air drives. The main question has been, "Are we simply applying a water drive on the core and getting the same effects as would be obtained by imposing a regular water drive following an air drive?" A curve in Fig. 1 was obtained in an attempt to answer this question. The core was 100 per cent saturated with close-cut oil and driven as before with a 20-cm. mercury air drive. This is the same procedure that was used in the initial close-cut oil curve.

The core was produced to a 54 per cent oil saturation at which time no more oil was being produced and the economic limit had been reached. The core was then given a 20-cm. mercury water drive; this is the same pressure that had been used in previous runs. The water drive produced 19 per cent additional oil but was not quite as efficient as the method of water injection by slugs. Approximately 6 per cent more oil was recovered when water was injected by slugs than when a complete water drive was imposed on the core. From this laboratory study it appears that to obtain maximum oil recoveries in the field, the water must be injected in the form of a slug.

In Fig. 1 the last water injection during the close-cut oil test was a 19 per cent slug of water. To inject this percentage of water into a formation in a 300-ft. five spot with a 12 per cent porosity would require 363 bbl. of water per foot of sand. This amounts to 9.3 bbl. of water per acre per foot of sand for each per cent increase in water saturation. This is assuming the water to be spread uniformly throughout the formation. This figure is given as a comparison of the volumes of water required in the field to the laboratory water injections.

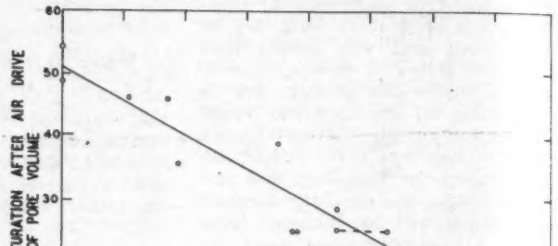
Fig. 2 is a graph of oil saturation as per cent of pore volume of the core against the cumulative gas volumes in pore volumes through the core for the three runs previously discussed. It can be seen from the curves that the effect of water injection on the amount of gas required is beneficial. A definite deflection of the gas volume curve for each water injection proves this point.

Fig. 3 is a graph of oil saturation in per cent of pore volumes of the

*The low water saturation of 15 per cent was obtained by evaporating water from the core.

Fig. 7—(Above) Water and oil saturation vs. gas volumes for air driven-water injected core R-9 (Cow Run sand, P = 20 cm. Hg.)

Fig. 8—(Right) Residual oil saturation vs. water saturation for air driven-water injected core R-9 (Cow Run sand, P = 20 cm. Hg.)


RESIDUAL OF SATURATION AFTER AIR DRIVE % OF PORE VOLUME
MINIMUM WATER SATURATION FROM CAPILLARY PRESSURE CURVE
WATER SATURATION % OF PORE VOLUME

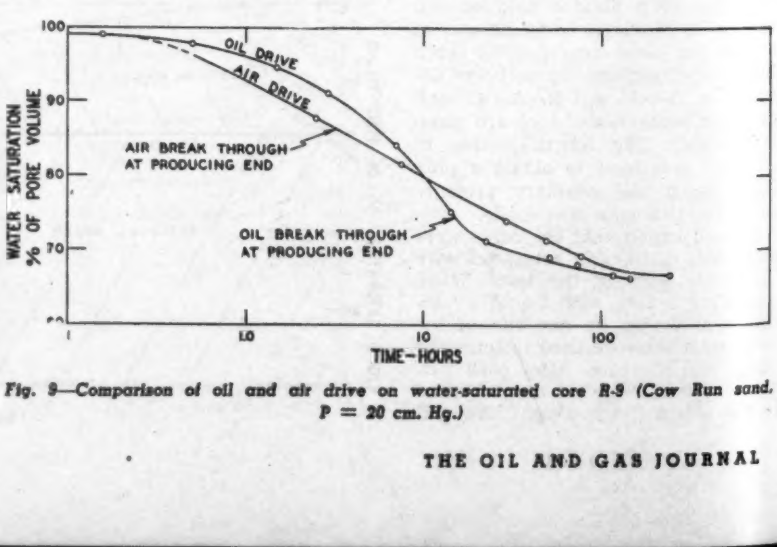


Fig. 9—Comparison of oil and air drive on water-saturated core R-9 (Cow Run sand, P = 20 cm. Hg.)

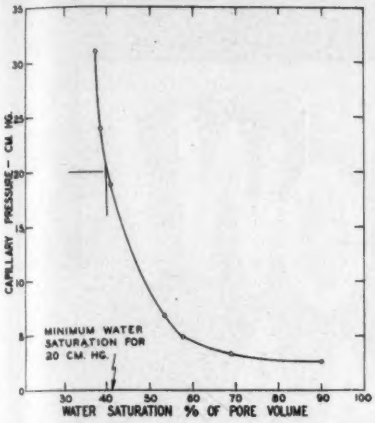


Fig. 10—Water saturation vs. capillary pressure (Core R-9, Cow Run sand)

core versus calculated produced gas-oil ratios in cubic feet of gas per barrel of oil for the runs perviously described. The calculated gas-oil ratios are extreme in some cases and not within the field limits, but this was more or less intentional since all runs were continued as long as oil was being produced from the core. This fact will have no bearing on the trends of the curves. It can be seen from the close-cut oil curve in Fig. 3 that the gas-oil ratio rapidly increases prior to water injection. When the first slug of water is injected into the core the gas-oil ratios are immediately cut back to 1/200 of the previous value. The second water injection results in an even larger reduction in the gas-oil ratio. These results are comparable to those of selective plugging in air-gas drive. The high-permeability formations through which large amounts of air are being moved have been partially plugged with water. The plug will be selective to a certain extent for a greater amount of water will enter the more permeable zones and thus will tend to reduce the flow of air through those zones. This plug will not be permanent, for as air pressure is applied behind the slug of water the liquid will spread before the air front. Eventually the liquid bank will be exhausted and air will begin to break through to the producing wells. The reduction in gas-oil ratios was approximately the same when crude oil was used, but to eliminate confusion the curve was not drawn on Fig. 3.

The rates of flow of air during water-injection studies may be further clarified by a study of the change in air permeability during these experiments. The relative permeability-saturation relationship contains the basic information which is required. Fig. 4 is a graph of the "average" relative permeability to air (Kg/K) versus the average oil saturation throughout the core in per cent of pore volume of the core. This curve is plotted as "average" relative permeability because the calculations differ in several ways from the commonly accepted steady-state relative permeability curve.

The laboratory curves are from necessity based on the measured air produced from the end of the core over a period of time under changing conditions. A pile up of liquid at the producing end of a core or "end effect" is known to influence the rate of flow of gas from the core. The saturations as shown on Fig. 4 are also from necessity only average saturations throughout the core, since individual oil saturations in each section of the core could not be measured. The dashed curve* in this figure is the steady-state relative air permeability. Beginning at the 100 per cent oil saturation point and following the solid curve, a relative permeability (Kg/K) of 0.37 and 49 per cent average oil saturation was reached. The relative permeability to air was quite high and as a result large volumes of air were injected into the sand. An 18.8 per cent slug of water was added to the core at this point. When the air drive was repeated the relative permeability to air had been reduced almost to zero. As shown by the curves, each time a slug of water was injected the air permeability was reduced.

In connection with any study of the flow of air through a formation, the influence of the percentage of oil and water saturations must be recognized. The amounts of liquid in the formation will regulate to a great extent the permeability to air. To illustrate this relationship the curves of Fig. 5 have been drawn. The ratio of the gas-liquid saturations within the core at any one time during the water-injection runs has been plotted against the gas-oil ratio produced from the core. Since the core was 100 per cent oil saturated at the beginning of the experiment, the gas-liquid ratio will be zero at the start. As liquid is produced from the core both the gas-liquid and gas-oil ratios increase.

After the first 18.8 per cent water injection, the amount of liquid present in the core increased and as a result the gas-liquid ratio decreased. The gas-oil ratio also decreased because of the reduced flow of air. Each water injection shows this general relationship; therefore in actual practice, a high liquid saturation may be desirable as a means of reducing the amount of air through the formation. This high liquid saturation could be composed mostly of water but the permeability of this water must not be too great or excessive

*Data by R. J. Day, Air-Gas Drive Research Program, The Pennsylvania State College.

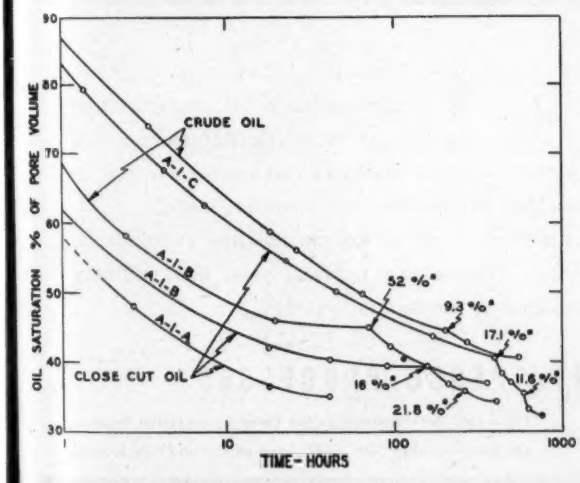
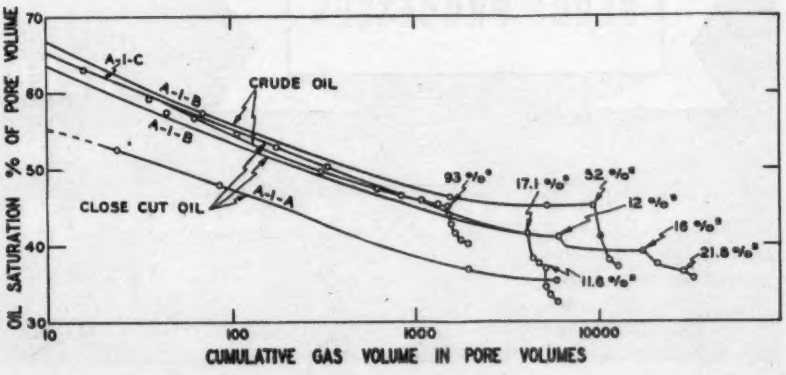
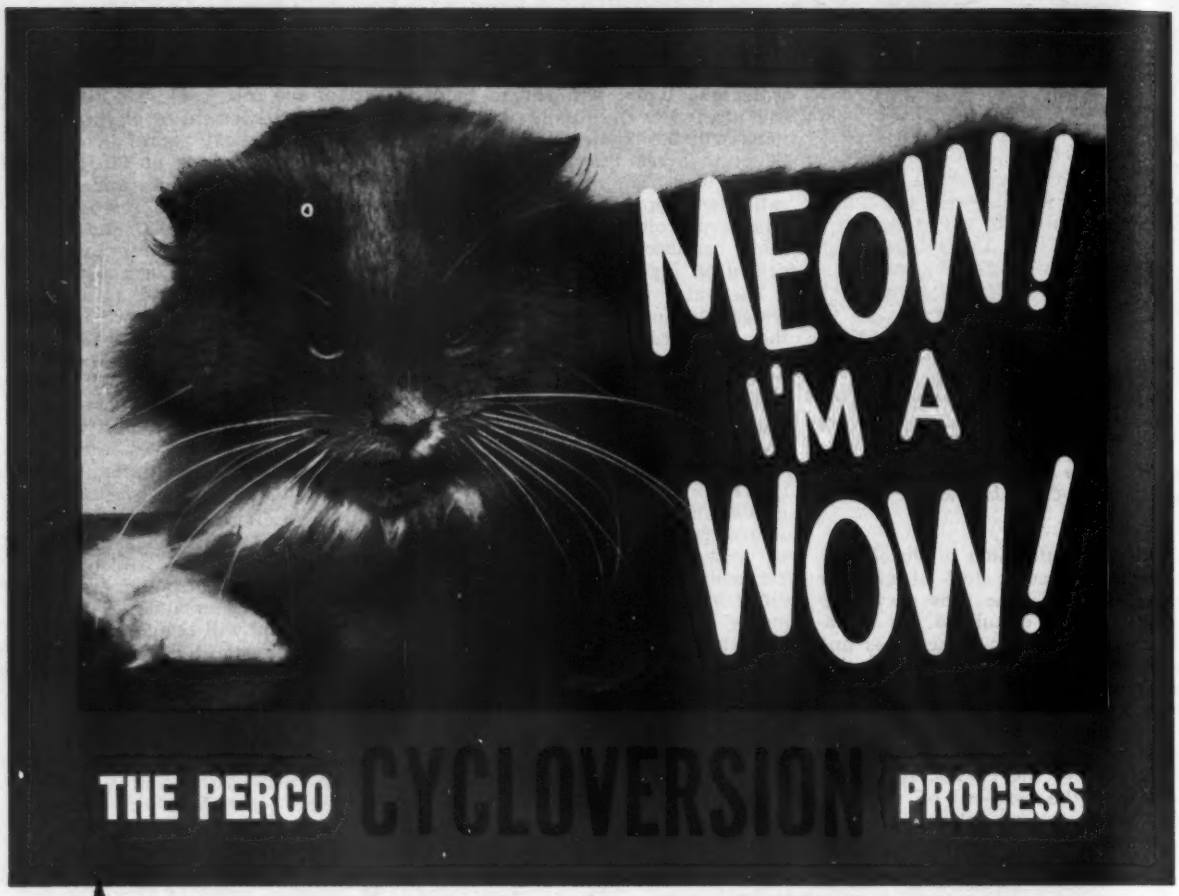


*Fig. 11—(Left) Saturation vs. time for air driven-water injected core A-1 (Venango sand, P = 50 cm. Hg.). *Signifies when water added*

*Fig. 12—(Below) Saturation vs. gas volume for air driven-water injected core A-1 (Venango sand, P = 50 cm. Hg.). *Signifies when water added*





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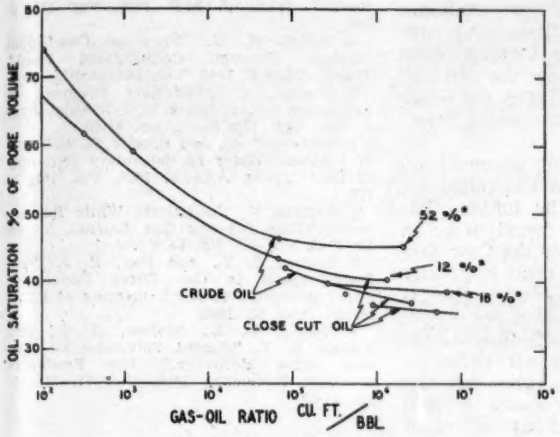


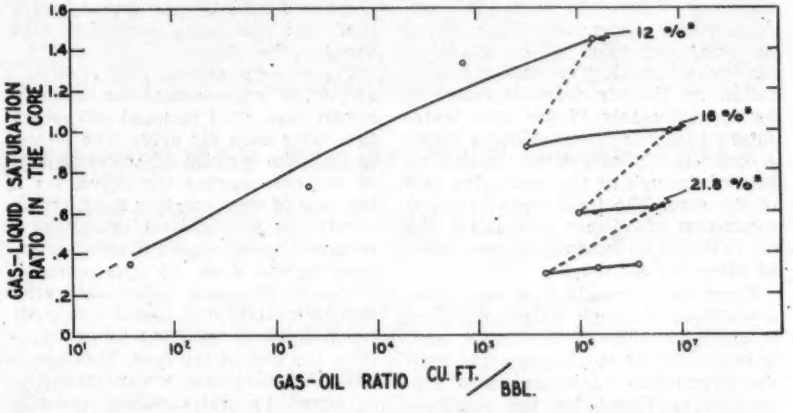
*Fig. 13—(Left) Saturation vs. gas-oil ratio for air driven-water injected Core A-1 (Venango sand, P = 50 cm. Hg.). *Signifies when water added*

*Fig. 14—(Below) Gas-liquid ratio vs. gas-oil ratio for air driven-water injected core A-1 (Venango sand, P = 50 cm. Hg.). *Signifies when water added*

Fig. 8 is a general plot of the preceding experiments in which residual oil saturations in per cent of pore volume of the core are plotted against water saturations in per cent of pore volume. These data represent the saturations at the end of the individual air drives (dotted line shows water produced during a single air drive). From the curve it can be seen that at zero water saturation (i.e., when the core has been 100 per cent oil saturated and then driven with air at 20 cm. mercury), the residual oil saturation is found to be approximately 52 per cent. If 20 per cent water is added to the core the residual oil saturation after an air drive is reduced to 41 per cent oil.

water-oil ratios will be produced. Also with high liquid saturations an increased effective pressure may be imposed on the low-permeability formation.

Until now the discussion has dealt with cores which have 100 per cent or very nearly 100 per cent oil saturated, and the effects of water injection on these cores have been shown. It is also necessary to study the effect of high initial water saturations within the core prior to water injections. To prepare for such a test requires, first, that the core be 100 per cent saturated with water, and next, that an oil drive be imposed which reduces the water saturation and supplies the oil for the test. Such an experiment is illustrated in Fig. 6. The core at the end of the oil drive was 100 per cent liquid saturated, as shown by the figure, i.e., 66 per cent water saturated and 34 per cent oil saturated. A 20-cm. mercury air drive was imposed on this core and from Fig. 6, which is a plot of per cent liquid saturation versus time of drive in hours, the oil saturation was reduced from 34 to 18 per cent in 145 hours. During this air drive the residual water saturation was reduced by only 4 per cent. After the core was considered at an economic limit, a 3 per cent slug of water was added. The core was again air driven with the result that 4 per cent additional oil (based on total pore volume) was obtained. Fig. 7 is a graph of liquid saturation versus gas volumes through the core, and from this curve can be seen the value of the water injection during this experiment. These figures point out the conditions under which water injections may be beneficial.



In the experiments represented by Figs. 1 to 7 inclusive the amounts of water have been varied and the resulting residual oil saturations after air driving have been determined. If 40 per cent water is added the residual saturation is reduced to 30 per cent oil.

As the per cent water saturation is increased the residual oil saturation is reduced. This statement is correct up to a certain water saturation. At this point the permeability to water increases to a value where water is produced from the core. Any additional water added to the core above this point will in turn allow water to be produced from the end of the core. This critical point was found to be about 55 per cent water saturation, although as seen by Fig.

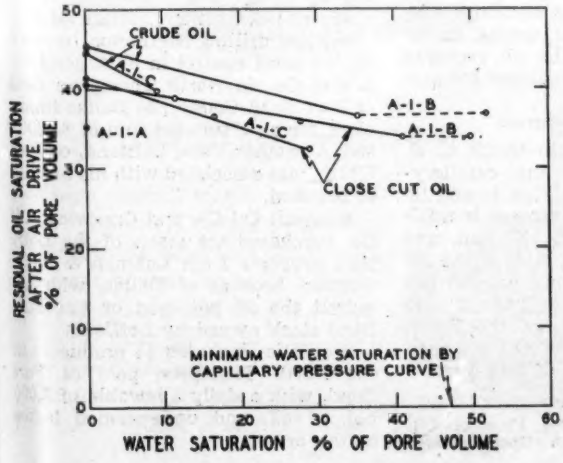
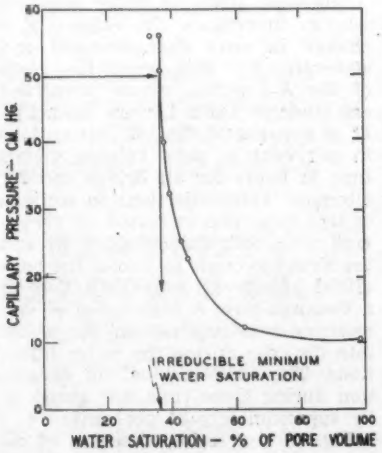


Fig. 15—(Left) Residual oil saturation vs. water saturation for air driven-water injected core A-1 (Venango sand, P = 50 cm. Hg.)

Fig. 16—(Right) Water saturation vs. capillary pressure (core A-1, Venango sand)



8, water injection was beneficial to oil production up to about 65 per cent water saturation without an excessive water-oil ratio. In other words, the relative permeability to water is insignificant below 65 per cent water saturation. This is substantiated by both an air drive and an oil drive on the completely water-saturated core (see Fig. 9), these drives being also at 20 cm. mercury pressure differential. The capillary pressure curve given in Fig. 10 indicates that the point for this core at which the water should flow is approximately 40 per cent. In actual experiments water was produced from the core at approximately 55 per cent water saturation.

The curves of Fig. 9 are a plot of water saturation in this core against the time of drive in hours. The air-drive curve is a smooth line showing no great deflection at the point of air breakthrough. The ultimate saturation by the air drive is found to be approximately 67 per cent water saturation. The oil-drive curve shows a definite deflection when the oil breaks through at the producing end of the core. The final residual water saturation of 66 per cent after the oil drive is approximately the same as after the air drive.

From these results it appears that a practical minimum water saturation is approximately 66 to 67 per cent. It is of interest to compare this with the irreducible minimum water saturation as found by the capillary pressure curve for a plug from the end of this core (Fig. 10). The irreducible minimum water saturation as found by the capillary pressure curve for a plug from the end of this core (Fig. 10). The irreducible minimum water saturation by capillary pressure at 20 cm. mercury was found to be approximately 40 per cent. This discrepancy may be partially accounted for on the basis of "end effect" in the experiments, and partially on the basis of the low water permeability below 65 per cent water saturation.

Water Injection in Venango Sand

The next study of water injection was to investigate the effects of a change in sand characteristics and structure. For this work the cores of the A-1 series, whose properties are given in Table 1, were used. Fig. 11 is a curve of the oil saturations in per cent of pore volume versus time in hours for air drives and for alternate water injections on sections of this core. The increased oil recovered with both the close-cut oil and the Venango crude oil shows the beneficial effects of water injection in a Venango core. A pressure of 50 cm. mercury was imposed on the water into the core during the water injections. The final residual oil saturation during these runs was found to be approximately 34 per cent.

Fig. 12 is a series of curves of oil saturations versus gas volumes through the core for these same runs on the sections of the Venango core. These curves also show the reduced gas volumes required for the additional oil recovered by water injections.

Fig. 13 is a plot of per cent oil saturations against gas-oil ratios for these runs. The results for the Venango sand core are found to be in general the same as for the Cow Run core, i.e., the gas-oil ratio is greatly reduced when a slug of water is added between the air drives.

Fig. 14 shows the effects of water injections on the gas-oil ratio vs. gas-liquid saturation ratio for the same core. This curve shows reduced gas-oil ratios as liquid saturations of the core are increased. Water injections will increase the liquid saturations and will cause less gas to blow through the core.

Fig. 15 is a summary of results of air drive experiments on the Venango core. The residual oil saturation after each air drive was plotted against the amount of water present in the core during the drive. As in the case of the Cow Run sand experiments, the residual oil saturation is reduced by increased water saturations in the core. At approximately 35 to 40 per cent water saturation the permeability to water was sufficient to allow water to be produced from the end of the core. This agrees with the minimum water saturation as found by the capillary pressure curve for core A-1, shown in Fig. 16. The plug core used to obtain the data was drilled from the fourth section of long core A-1. An irreducible minimum water saturation of 36 per cent is indicated by the capillary pressure curve. This saturation may be the connate-water saturation in the formation. (As in the case of the Cow Run sand experiments, water injected in addition to the minimum water saturation resulted in more oil being produced.

Summary

This paper has attempted to show the value of water injections during an air drive. From the data offered it appears that under certain conditions water injections during an air drive will increase the oil recovery and decrease the air required for production.

Acknowledgements

The writer wishes to thank C. D. Stahl for obtaining the capillary-pressure data given in Figs. 10 and 16.

Grateful acknowledgement is made to S. T. Yuster, R. F. Nielsen, and other members of the staff of the division of petroleum and natural gas engineering for their interest and help and to members of the Pennsylvania Grade Crude Oil Association for their support of this work.

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Bottom-Hole Flowmeter Licensed by Lane-Wells

Through a contract agreement, Stanolind Oil & Gas Co. has granted Lane-Wells Co. the use of its recently developed bottom-hole gas-well flowmeter. The instrument can be lowered down the tubing of gas wells on a measuring line to record production from each gas sand while the well is flowing. The instrument may also be used on gas injection wells.

The gas-well flowmeter is reported by Stanolind to have been successfully used in 175 wells in Hugoton gas field of southwestern Kansas in planning and checking on the results of acidizing and workovers.

The instrument consists of a detecting element, a recording chart, and a small motor powered by flashlight batteries which operates the recording mechanism. The detecting element is a hot-wire anemometer connected in a Wheatstone bridge circuit to measure the resistance change of the hot wire as it is cooled by flowing fluids. This change is recorded on a chart as a function of time.

Loffland Sells Interests In Fort Bend Company

Thomas S. Loffland, Tulsa oil producer and drilling contractor, has sold all his stock control in Fort Bend Oil & Gas Co., in North Thompson field of Fort Bend County, to Dallas financiers, for an estimated sum of $3,000,000. A brother, Jack Loffland, of Fort Worth, was associated with his brother in the deal.

Batewell Oil Co. and Crestview Oil Co. purchased the assets of the Loffland property from Lohman & Neiswonder, brokers of Dallas, who acquired the 90 per cent of the Fort Bend stock owned by Loffland.

Properties included 14 producers in the North Thompson pool of Fort Bend, with a daily allowable of 2,000 bbl. of oil, and undeveloped leases in the area.

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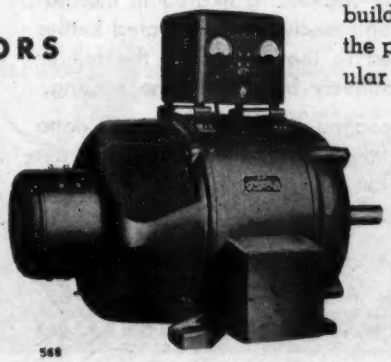

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Drill Collars—Their Use And Manufacture

(Continued from page 66)

since the outside surface is polished during service. A number of remedies have been tried for these fatigue failures, especially in West Texas.

One school of thought believes that the design of the threaded connection is at fault and that the A.P.I. taper joints are not inherently strong enough to resist service stresses. Accordingly, a number of variations of threaded connections have been advocated with changes in thread contour, shoulder bevel, taper, and other details. These have had some apparent success. However, trial strings are usually handled with more care, and operating conditions are watched more closely than in average operations. Consequently lack of trouble with a new departure from the standard joint does not necessarily prove success for the long run.

Speed of Rotation

It is well known that decreasing the speed of rotation will lessen the number of drill-collar joint failures. A long column of collars, although seemingly heavy and rigid, will flex to the wall of the hole and the centrifugal force of high-speed rotation will produce a whipping action of the collars which imposes considerable lateral stress on the joints. These stresses can be minimized by decreasing the speed of rotation and, as pointed out above in hard-rock drilling with the new types of bits, this is advantageous in assisting the teeth of the bit to dig in and take a proper bite rather than riding too rapidly.

Proof of this flexing action can be seen in wear measurements on collars and the general increase in joint trouble when small o.d. collars are run in a large hole. It must be noted, however, that in California where rotation at more than 250 r.p.m. is the rule rather than the exception, joint troubles are at least no worse than east of the Rockies. Some evidence indicates that there is a critical rotary speed range at which whipping action is intensified.

Still another group attempts to evade pin breaks by using double-box collars with double-pin connecting subs. The theory is that failures will then occur in an easily replaceable component. Inasmuch as it is advisable to reshop the mating drill-collar box when a pin breaks, in normal times when drill collars are easily obtainable, the advantages of double-box collars are largely imaginary. Operators who can afford to have plenty of spare collars are abandoning the double box with double-pin connectors in favor of the box-pin type and thus halving the number of make and break joints.

The problem with drill-collar connections can be solved to a large degree by maintaining elastic tightness at the shoulder. If the shoulder and reactive thread elements remain tight during drilling, there can be no movement and no wear or damage to the threads. The first essential in maintaining this contact is that the joints be set up tight enough and that they have the strength to maintain this tightness. Second, drill collars must be made with the axis of the threaded joint in line with the axis of the collar and the collar must be straight within close tolerances. Kinks or misalignment in drill collars impose a whipping action during rotation which puts high stresses on the joints. Such stresses may develop strains in the joints which will loosen the elastic shoulder contact and result in wobble motion with the attendant damage that has been mentioned. With shoulder contact lost, rock bits aggravate the tendency to unscrew because of their free rotation. Drag bits were much better in this respect because the torque applied at the rotary table helped to keep all the joints in the string tight.

2. Fishing difficulties.—Many operators dread a drill-collar break because of the difficulties sometimes encountered when fishing for a string of many collars. It was once general

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practice to use smaller collars so that they could be recovered by washing over. The advent of long strings makes washing over almost impossible on account of the difficulty of cutting thick-walled hard collars. Now the usual practice is to run the largest collar that can be recovered with an overshot. In West Texas most operators use straight-sided collars except where they have very small clearances in drilling inside the casing, in which case some companies neck down the upper end of the collar for fishing purposes.

In recent years, the design of slips in overshots has been improved to the point where this tool is capable of taking a good grip on a smooth surface. However, it is still the practice among some tool pushers to specify collars with overshot grooves for easier fishing. This weakens the collar somewhat and may also start wedging in a crumbling hole, both of which are undesirable.

3. Handling difficulties.—Drill collars require more care in handling than drill pipe, both on the road and at the rig. Proper attention must be given to loading, supporting, and transporting them in order to avoid excessive bending stresses in rough terrain. Some operators use a pipe scabbard for severe road conditions. Extra weight of collars makes them somewhat more difficult to handle in a rig, especially when drilling under a mast. Collars also require more care than drill pipe in making, breaking, and inspecting joints.

4. Deviation from straightness.—Excessively heavy weight on the drill bit promotes deviation from straightness in drilling. This is a serious consideration when crooked-hole penalties are written into contracts, but drillers in West Texas have been able to minimize this trouble by frequent straight-hole measurements. When off vertical too much, some collars are removed and the rotary speed increased to bring the hole back. Reamers are also helpful in straightening the hole and keeping it straight.

5. High initial cost.—Drill collars cost approximately 10 times more than equal lengths of drill pipe. A small contractor in competitive areas finds it hard to justify the added expense, especially when formations are soft and penetration is limited more by the pump pressure required to circulate drilling mud than by drilling. In these areas it is commonly preferred to misuse the drill pipe and tool joints by running only one collar where four or five might be necessary to drill in tension, than make an extra expenditure of several thousand dollars. However, it is believed that this is false economy and a careful reexamination of drilling costs would show, barring extra fishing jobs which may or may not accrue from using more collars, that real benefits result from drilling with the proper number of collars.

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THE ROLE OF DISPERSANTS IN LUBRICATING OILS

*by H. H. Zuidema**

THIRD OF THREE PARTS

EVALUATION OF ADDITIVES

1. **Engine test.**—To determine whether or not a given additive will reduce the tendency of a given oil to lacquer, it is necessary only to run Lauson engine tests with and without the additive. However, it is possible with the further expenditure of only a relatively small amount of time and effort to evaluate the additive fairly completely with respect to mechanism. Lauson tests, both with the combination of a lacquering oil and a non-lacquering fuel and with the combination of a white oil and a lacquering gasoline, along with laboratory oxygen-absorption tests, both with and without metals present, provide sufficient data to supply a reasonably complete picture.

Behavior of three types of additives in these tests is summarized in Table 5. The three types behave quite differently when performance under all conditions is considered. It must be recognized, of course, that many commercial additives are mixtures containing two or more of these types; in some instances two or three functions may be included in a single molecule.

Detergent properties of all oil, i.e., the ability to remove previously formed deposits, can be determined by running the oil in a prelacquered engine. McNab et al[18] have reported considerable removal of engine deposits from an automobile diesel engine by the use of an additive which they describe as a detergent-dispersers-inhibitor. Georgi[1] has shown that heavy-duty oils, which contain anti-flocculants, exert considerable detergent properties on engine deposits of a soft and grease-like nature which occur where the oil circulation is vigorous. However, he found it necessary to use a material having a true solvent action to remove the hard, adherent deposits or the soft deposits

*Shell Oil Co., Inc., research laboratories, Wood River, Ill.

CHARACTERISTICS OF AN IDEAL DISPERSANT

On the basis of this and the two preceding articles (The Oil and Gas Journal January 8 and January 15 issues) it is possible to formulate the following characteristics which a dispersant should possess:

1. ABILITY TO PREVENT FLOCCULATION OF OIL INSOLUBLES

This is, of course, the primary requirement of this type of additive.

2. ABSENCE OF HARMFUL EFFECTS UPON OTHER PROPERTIES

The compound should not adversely affect the physical or chemical properties of the oil, e.g. pour point, viscosity-temperature slope, oxidation stability, corrodibility of bearings, etc.

3. SOLUBILITY IN BASE STOCK AND COMPATIBILITY WITH OTHER ADDITIVES

The dispersant must not separate from solution at low temperatures and must be compatible with other addition agents such as antioxidants, passivators, pour-point depressors, antifoam agents, etc., which may be present in the oil.

4. STABILITY TO OXIDATION, HYDROLYSIS, AND HIGH TEMPERATURES

Many compounds which are effective dispersants at room temperature fail in practice because of poor thermal stability or ease of oxidation or hydrolysis. The extent of stability required varies with the application.

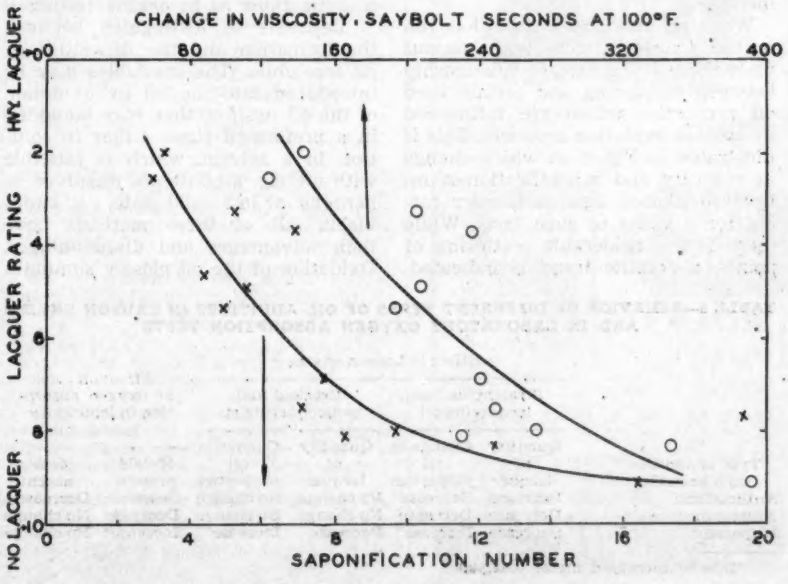

Fig. 6—Relationship between lacquer rating and used-oil properties in Lauson-engine tests on undoped white oil used in conjunction with various fuels

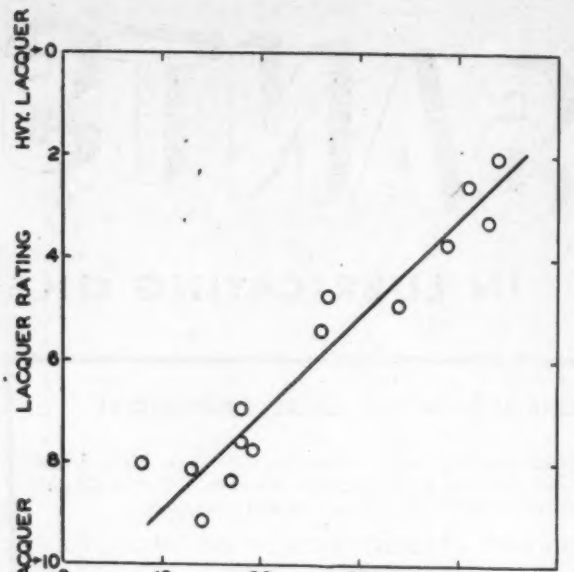

Fig. 7—Correlation between naphtha insolubles in used oil and lacquer rating in Lauson engine. Lubricant, white oil, fuel, various gasolines

occurring in areas where oil flow is limited.

Relationship between lacquer rating and used oil properties depends almost entirely upon the oil and fuel used. With similar oils of varying stability but without added dispersant in conjunction with a nonlacquering fuel the used oil properties, such as saponification number, neutralization number, change in viscosity, etc., would be expected to parallel the lacquer ratings. The presence of a dispersant would of course upset such correlations, for the lacquering tendency would be reduced while overall oxidation would in most cases be increased.

When an undoped white oil is run in the Lauson engine with various fuels there is an inverse relationship between lacquering and certain used oil properties which are influenced by soluble oxidation products. This is illustrated in Fig. 6, in which change in viscosity and saponification number are plotted against lacquer rating for a series of such tests. While there is a considerable scattering of points, a definite trend is indicated. The increased oxidation accompanying decreased lacquer deposition is attributable to increased metal catalysis by exposed engine parts. There is in this case no direct connection between extent of oxidation of the oil and the quantity of lacquer or oil-insolubles formed, for these originate in the fuel. Correlations similar to those shown in Fig. 6 would be expected if a given oil and fuel were run with varying concentrations or kinds of dispersant.

A general relationship might be expected between lacquer rating and oil insolubles as determined by high-speed centrifugation. Few if any data are available on this point, however, and the nearest approach is the determination of naphtha insolubles. The relationship between oil insolubles and naphtha insolubles is not constant. It varies with such factors as composition of the oil, composition of the insolubles, and the presence of dispersants. However, for a given oil and for insolubles from a common sourse, the factor relating oil insolubles and naphtha insolubles should be fairly constant. The relationship between lacquer rating and naphtha insolubles for white oil run with various fuels is shown in Fig. 7.

2. Laboratory tests.—In laboratory investigations as in engine testing it is desirable to distinguish between the formation and the deposition of oil insolubles. The insolubles may be introduced into the oil by oxidation of the oil itself or they may be added in a preformed state, either in solution in a solvent which is miscible with oil, e.g. asphaltenes dissolved in benzene, or in a solid state, e.g. lampblack. All of these methods have their advantages and disadvantages. Oxidation of the oil closely simulates engine behavior as far as the formation of insolubles derived from the oil is concerned. However, it does not take into consideration the effect of fuels. Furthermore, it complicates the evaluation of additives, for antioxidants as well as dispersants reduce the quantity of lacquer or sludge recovered.

Use of a benzene solution of asphaltenes, preferably obtained from used engine oils, has the advantage of separating the effects of oxidation and flocculation. This method, namely of replacing one solvent, in this case benzene, with another, in this case lubricating oil, is a standard method for preparing colloidal solutions. Its main disadvantage as applied to this problem is the difficulty of obtaining a standard and reproducible source of asphaltenes or oil insolubles. Lampblack has been used by Talley and Larsen[17] to simulate soot deposits formed in diesel engines. It is probably more easily defined and reproduced than asphaltenes since it more nearly approaches being a definite chemical substance. However, it must be added as a solid and in a state of aggregation outside of the colloidal range.

There are several methods for determining the extent of flocculation of oil insolubles. Most direct for qualitative purposes is a simple microscopic examination. For quantitative work filtration or high speed centrifugation may be employed.

Additional methods are the chromatographic technique used by Talley and Larsen in connection with their studies with lampblack, and effect upon infrared radiation. Talley and Larsen[17] have described four tests which employ various combinations of introduction of oil insolubles and determination of the degree of peptization. The first two employ oxidation of the oil for forming the insolubles and high-speed centrifugation and transmission of infrared light of 9,700 Angstrom units wave length, respectively, for detecting peptization. The third is the Wood River method in which a benzene solution of asphaltenes is added to the oil, followed by filtration. The last is the chromatographic method in which lampblack is added to oil which is then filtered through a column of sand and depth of penetration by lampblack noted.

TABLE 3—BEHAVIOR OF DIFFERENT TYPES OF OIL ADDITIVES IN LAUSON ENGINE AND IN LABORATORY OXYGEN ABSORPTION TESTS

	Effect in Lauson engine				Effect on rate of oxygen absorption in laboratory tests on oil	
	Straightrun fuel, lacquering oil		Cracked fuel, nonlacquering oil			
Type of additive in lubricating oil—	Quantity of lacquer	Change in oil properties	Quantity of lacquer	Change in oil properties	Metals present	Metals absent
Antioxidant	Decrease	Decrease	No change	No change	Decrease	Decrease
Anticatalyst	Decrease	Decrease	No change	No change	Decrease	No change
Dispersant	Decrease	Increase*	Decrease	Increase*	Increase*	No change

*Due to increased metal catalysis.

Acknowledgment

The writer wishes to express his gratitude to H. R. Kemmerer and F. L. Johnston for most of these original data.

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APPENDIX-SUMMARY OF U. S. PATENTS* ON DISPERSANTS FOR USE IN LUBRICATING OILS

Pat. No. and date issued	Inventor	Compound
1,628,647 5-17-27	Becker, A. E.	Alkali metal soap of fatty acid, to reduce carbon formation on cylinder walls
1,868,974 11-29-32	Becker, A. E.	Alkali metal soap of fatty acid + oil soluble alkali metal sulfonate, the latter to give increased penetration for use in wick-feed systems
2,001,108 5-14-35	Parker, C. K.	Naphthenate of calcium or other metal, e.g., Mn, Pb, Zn, Cu, Al, Co, for use in lubricating oil or transformer oil to "retard the polymerization effect or reaction"
2,032,279 3-25-36	Griffith, A. A. and Hilmore	Chromium oleate to prevent gumming and sludging
2,059,567 11-3-36	Evans, E. A.	Chromium and tin oleates in combination, also these two + tetraethyl lead
2,069,273 2-2-37	Rosen, R.	Synthetic hydrocarbon and high H/C ratio, e.g., Voltol, polymerized olefins, reaction product olefin + aromatic
2,069,274 2-2-37	Rosen, R.	Condensation product made from cracked wax olefins with $AlCl_3$ catalyst
2,081,075 5-18-37	Vobach, A. C.	Calcium phenyl stearate, also calcium stearate and phenyl stearic acid
2,095,538 10-12-37	Vobach, A. C.	Calcium phenyl stearic acid + stearic acid or palmitic acid
2,135,092 11-1-38	Maverick, G. M.	"Built up" lubricating oil containing Voltol or chemically polymerized olefins as sludge disperser
2,144,078 1-17-39	Neely, G. L.	Aluminum dinaphthenate to "reduce ring sticking, prevent agglomeration of deposits, and also to remove previous deposits on pistons, rocker arms, etc."
2,149,856 3-7-39	McKone, L. J. and Lyons, W. E.	Mixture of metal derivatives of beta diketones; one metal from the group Pt, Pd, Co, Ni, U, Zn, Mo, Cu, Fe, W, and the other from the group Ce, Th, Zr, Be, Ba, Cr, Ti, V, Cs, B, Al, La
2,163,622 6-27-39	Neely, G. L. and Kavanagh, F. W.	Oil-soluble metal naphthenate + free acid to prevent gel formation. Metals include Al, Zn, Mg, Ca, Cd, Mn, Sn
2,171,781 9-5-39	Cantelo, R. C.	Metal salt of erucic acid, e.g. Al erucate. (Erucic acid, $CH_3(CH_2)_7—CH=CH(CH_2)_{11}—COOH$ is the chief constituent or rapeseed oil)
2,180,697 11-21-39	Vobach, A. C.	Phenyl stearates of Al, Ba, Cd, Cr, Mg, Ni
2,180,698 11-21-39	Vobach, A. C.	Stannous phenyl stearate
2,180,699 11-21-39	Vobach, A. C.	Zinc phenyl stearate
2,181,913 12-5-39	Rosen, R.	Organo-metallic agents—metal from second, third, and fifth groups, e.g. tolyl mercury, triphenyl bismuth, diphenyl chlor arsine
2,181,914 12-5-39	Rosen, R.	Organo-metallic compounds, e.g. triphenyl tin iodide
2,181,915 12-5-39	Rosen, R.	Similar to 2,181,913
2,186,346 1-9-40	Ricketts, V. L.	Polyvalent or amphoteric metal salt of higher fatty acid containing an aromatic side group, e.g. Mg benzal stearate (alpha benzal stearic acid is made from Ca stearate + benzaldehyde in acetic anhydride solution)
2,197,153 4-16-40	Merrill, D. R.	Oil soluble soap of unsaturated fatty acid of at least 10 C atoms condensed with aryl compound, e.g. Ca phenyl stearate
2,198,307	Hope, G. A., Linton, W. L., and Pratt, M. F.	Salts of structure $M(OOCC—H_{2n}—O—R)_x$, where M is polyvalent metal, e.g. Al, Co, R is hydrocarbon group, and x is valence of the metal
2,198,851 4-30-40	Wiezevich, P. J., Zimmer, J. C., and Morway, A. J.	Al stearate or other Al soap + ester of polyhydroxy alcohol and monobasic acid or monohydroxy alcohol and polybasic acid. The purpose of the ester is to prevent gel formation in the oil
2,202,364 5-28-40	Wiezevich, P. J.	Al soaps of acids obtained by oxidizing waxy hydrocarbons or crude wax
2,202,826 6-4-40	Brandes, O. L.	Ni naphthenate + phenol, e.g. S.P.C.

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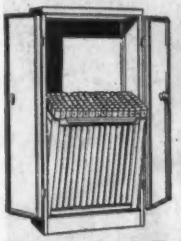

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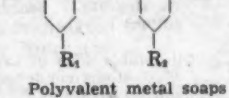
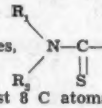
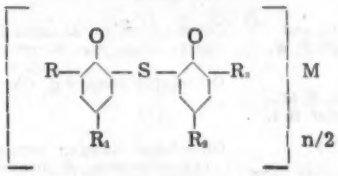
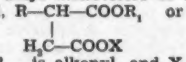
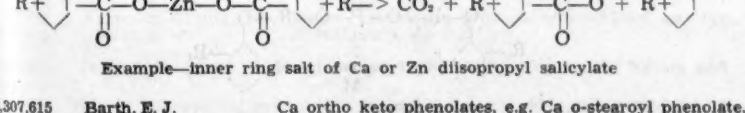
Pat. No. and date issued	Inventor	Compound
2,211,922 8-20-40	Gardiner, E. W., and Denison, G. H.	Al phenates, e.g. Al di cetyl phenate, HO-Al—(O—C_6H_4—$C_{16}H_{33}$)$_2$
2,218,618 10-22-40	McNab, J. G., and Watkins, W. T.	Polyvalent metal soap of substantially nondistillable organic acids obtained by oxidation of petroleum hydrocarbon or wax. Metals include alkaline earths, Co, and Ni
2,220,287 11-5-40	Rosen, R.	Voltolized olefins of 400-10,000 molecular weight
2,223,473 12-3-40	Wiezevich, P. J.	Metal soaps, e.g. Na, Ca, Al, or Pb, of licanic acid and hydrogenated licanic acid. Licanic acid has the following structure: $CH_3(CH_2)_3$—CH=CH—CH=CH—CH=CH—$(CH_2)_4$—$CO(CH_2)_3$—COOH
2,225,365 12-17-40	Bray, U. B.	Oil-soluble metal soap of chlorinated fatty acid, e.g. Ca dichloro stearate. Also metal soap containing S, P, or halogen
2,225,366 12-17-40	Bray, U. B.	Oil-soluble soap of organic acid of at least 10 C atoms and containing film strength constituent (halogen, S, or P)
2,225,367 12-17-40	Bray, U. B.	Oil-soluble soap of synthetic petroleum acid containing halogen, S, or P, e.g. Ca soap of chlorinated oleic or stearic acid
2,227,149 12-31-40	Murphree, E. V.	Polyvalent metal soaps and acids made by oxidizing "sweater oil" obtained from petroleum wax
2,228,661 1-14-41	Gardiner, E. W., and Denison, G. H.	Alkaline earth phenates, e.g. Ca cetyl phenate, Ba lauryl phenate
2,228,671 1-14-41	Neely, G. L., and Gardiner, E. W.	Metal phenate + salt of organic phosphorus acid, e.g. Ca cetyl phenate + Ca cetyl phosphate
2,229,528 1-21-41	Shoemaker, B. H.	Heavy metal alcoholates, $M(XR)_n$, where M is metal of valence n, X is O or S, and R is an alkyl, aryl, aralkyl, or hydroaryl group. Examples, Zn octylate, Al thio amylate
2,229,858 1-28-41	McConnell, E. R.	Cyclohexyl amines, mono, di, or tri
2,231,022 2-11-41	Merrill, D. R.	Oil-soluble soap of hydrogenated rosin acids, e.g Ca soap of hydrogenated abietic acid
2,233,203 2-25-41	Flaxman, M. T.	Soaps of rosin acids, e.g. Ca soap of abietic acid
2,233,426 3-4-41	McNab, J. G.	Mixture of soaps containing at least two of the group consisting of Al, Ni, and an alkaline earth metal
2,234,00[illegible] 3-4-41	Loane, C. M., and Shoemaker, B. H.	Organic aluminum sulfonates, e.g. Al petronate
2,236,120 3-25-41	Tousaint, N. F., Gaspari, H. R. R., and Ambrose, H. A.	Ni naphthenate—believed by inventors to function primarily as antioxidant, with "detergent" action incidental
2,236,168 3-25-41	Dietrich, M. A.	Organic sulfonamides, e.g. p-toluene sulfonamide
2,239,953 4-29-41	Fairlie, M.	Chloro calcium phenyl stearate, Cl—Ca—$OCC_{15}H_{28}C_6H_4$. Also in conjunction with calcium phenyl stearate, and both in conjunction with phenyl stearic acid
2,249,626 7-15-41	Cook, E. W., and Thomas, W. D.	Noncorrosive "detergent" R may be amyl; M may be Sn, Zn, Ba 
2,252,067 8-12-41	McNab, J. G., and Watkins, W. T.	Polyvalent metal soaps of acid produced by oxidizing petroleum oils and waxes, e.g. Al and Ni soaps
2,252,793 8-19-41	Watkins, F. M.	Ca phenyl stearate + solublizer + inhibitor, e.g. aromatic thioamide
2,252,984 8-19-41	Rutherford, J. T., and Miller, R. J.	Polyvalent metal salt of S-containing acid of phosphorus, e.g. Ca cetyl thio phosphate
2,252,985 8-19-41	Rutherford, J. T., and Miller, R. J.	Polyvalent metal salt of S-containing acid of phosphorus, e.g. Ca cetyl thio phosphate
2,253,399 8-19-41	Schott, J. E., and Churchill, L. R.	Al stearate + triethanolamine
2,253,585 8-26-41	Schott, J. E., and Churchill, L. R.	Al stearate + alkylolamine, e.g., triethanolamine

Pat. No. and date issued	Inventor	Compound
2,257,328 9-30-41	Bray, U. B.	Acid or metal soap of acid containing at least 10 C atoms
2,258,591 10-14-41	Moser, F. R., and Dijksman, A. J.	Zinc diisopropyl salicylate (Zinc Dips)
2,260,341 10-28-41	Schott, J. E.	Al stearate + butyl carbitol, the oil solution heated to 300°-340° F. before use
2,265,819 12-9-41	Rosen, R.	Organo diphosphines, e.g., tetraphenyl diphosphine $(C_6H_5)_2$—P—P—$(C_6H_5)_2$
2,265,851 12-16-41	Matheson, G. L.	Dithiocarbamates,  where R_2 + R_3 constitute at least 8 C atoms, e.g. Ni di n-butyl dithio carbamate
2,270,113 1-13-42	Clayton, J. O., and Farrington, B. B.	Metal salts of (1) higher fatty or aliphatic acids, e.g. Al laurate, tin oleate, Mg ricinoleate; (2) substituted phenols, e.g. Al, Sn, Zn, Mg. Ca, or Cr salts of cetyl phenol; (3) carboxylic acid with aryl substituent, e.g. Ca phenyl stearate; (4) naphthenic acids, e.g. Al, Cd, naphthenate
2,270,183 1-13-42	Cook, E. W., and Thomas, W. D.	2,4-dialkyl phenol sulfides, M is metal of valence n, and R is an alkyl group, e.g. Ba salt of p-tert. butyl O-cresol monosulfide, Zn or Sn salt or 2,4-diamyl phenol sulfide 
2,270,620 1-20-42	Bray, U. B.	Soap made by neutralizing oxidized paraffinic oil with lime
2,280,338 4-21-42	Merrill, D. R.	Carboxylic acid soap, e.g. Ca soap of abietic or hydrogenated rosin acid + chlorinated aromatic to prevent formation of hard carbon and sulfur compound to prevent corrosion
2,280,419 4-21-42	Wilson, C. E.	Petroleum sulfonate or its soap + salt of weak acid to prevent corrosion ("reserve alkalinity" agent)
2,280,474 4-21-42	Byrkit, G. D., Steiner, W. L., and Lincoln, B. H.	Salt of organic acid which contains ester group, e.g. Ca cetyl 3-isopropyl-6-methyl-3, 6-endoethylene-tetrahydrophthalate
2,280,475 4-21-42	Byrkit, G. D., Steiner, W. L., and Lincoln, B. H.	Metal salt of hydroxy acid whose OH group has been esterified, e.g. Ca Stearoyl salicylate, Ca benzoyl hydroxy stearate, Ca tetrakis hydroxy stearate
2,281,401 4-28-42	Wilson, C. E.	Soap as "detergent" + reserve alkalinity agent
2,281,623 5-5-42	Schott, J. E.	Al soap of fatty acid + glycol mono ether or diglycol monoether, e.g. Al distearate + butyl carbitol
2,281,824 5-5-42	Bray, U. B.	Alkaline earth soap, e.g. Ca chlorostearate or Ca phenyl stearate + compound of thio phenol derivative, e.g. alkylated thioether phenolate, to prevent corrosion
2,289,795 7-14-42	McNab, J. G.	Mixed soaps, Ni, Al, and Ca or Mg
2,292,308 8-4-42	Watkins, F. M.	Metal salts of alkyl monoesters of alkenyl substituted succinic acid, R—CH—$COOR_1$ or R—CH—COOX  R is alkyl, R_{1+} is alkenyl, and X is Ca, Al, Ba, Cd, Cr, Mg, Ni, Sn, or Zn. Example—basic Ca salt of lauryl monoester of laurenyl succinic acid
2,293,419 8-18-42	Van Ess, P. R.	Salt of hydroxy mono carboxylic acid heated to produce "inner ring" salt, e.g.  Example—inner ring salt of Ca or Zn diisopropyl salicylate
2,307,615 1-5-43	Barth, E. J.	Ca ortho keto phenolates, e.g. Ca o-stearoyl phenolate, Ca o-stearoyl 4 tert. butyl phenolate

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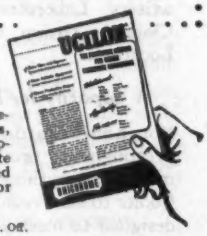

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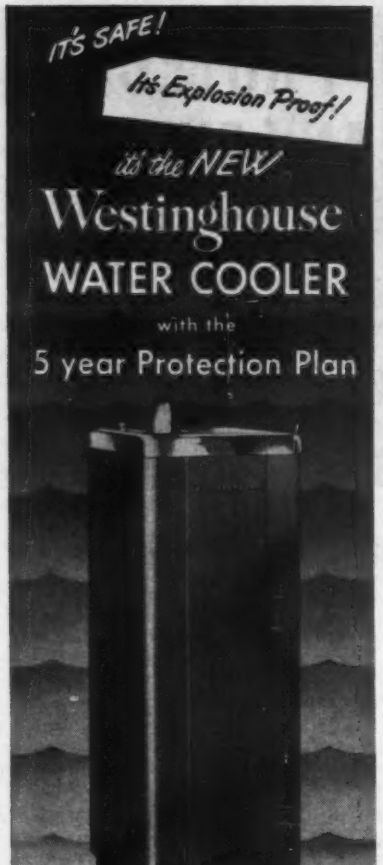

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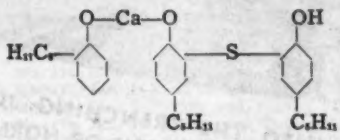
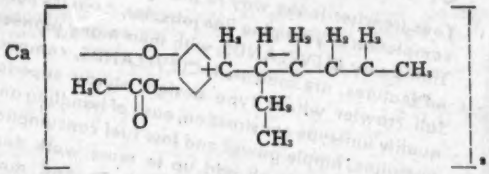
Westinghouse
WATER COOLERS

Pat. No. and date issued	Inventor	Compound
2,310,993 2-16-43	Prutton, C. F.	Ca phenyl stearate + organic halogen-containing compound, which imparts E.P. properties
2,319,662 5-18-43	Cook, E. W., and Thomas, W.D.	Phenol sulfides and metal salts of following structure: e.g. Ba 2-stearoyl 4-amyl phenol monosulfide, Al 2-stearoyl 4-amyl phenol monosulfide
2,320,228 5-25-43	Frey, D. R.	Mg lauryl salicylate and related compounds
2,320,392 6-1-43	White, E. R.	Salt of compound of following structure: $R_2-C(R_1)-COOH$, e.g. Ca alpha piperidine stearate
2,322,307 6-22-43	Neely, G. L., and Kavanagh, F. W.	Combination of Al salts of naphthenic and saturated fatty acids, e.g. Al dinaphthenate and Al stearate
2,329,474 9-14-43	Lazar, A., Ruedrich, P. M., and Frazier, R. L.	Oil-soluble soap, e.g. Ca, of abietic acid
2,330,238 9-28-43	Prutton, C. F.	Oil-soluble halogen compound + oxygen, e.g. o-dichlorobenzene + hexachlor diphenyl oxide; same combination + methyl stearate and butyl stearate
2,331,923 10-19-43	Musselman, J. M.	Metal, e.g. Ca compound of reaction product of P_2S_5 + degras, sperm oil, ester wax, or beeswax
2,336,070 12-7-43	Clarkson, R. G.	Amides made from polyamines and acids containing at least 14 C atoms, e.g. naphthenic acids + ethylene diamine, diethylene triamine, or triethylene tetramine
2,337,380 12-21-43	Finley, W. L., Kleinholz, M. P., and Watkins, F. M.	Ca salt of dialkyl, e.g. diamyl, salicylic acid amide. $(H_9C_5)_2-N-C(=O)-C_6H_4-O-Ca-O-C_6H_4-C(=O)-N-(C_5H_9)_2$
2,339,692 1-18-44	Finley, W. L.	Ca salt of capryl ester of salicylic acid, $Ca-(O-C_6H_4-C(=O)-O-CH(CH_3)-C_6H_{13})_2$
2,344,392 3-14-44	Cook, E. W., and Thomas, W. D.	Heavy metal salt of dicapryl ester of dithiophosphoric acid, eg..
2,344,393 3-14-44	Cook, E. W., and Thomas, W. D.	Zn salt of diamyl dithiophosphoric acid, $(C_5H_{11}-O_2-P(=S)-S-)_2Zn$
2,344,394 3-14-44	Cook, E. W., and Thomas, W. D.	Ba di (dihydro abietyl) dithiophosphate
2,344,395 3-14-44	Cook, E. W., and Thomas, W. D.	Diaryloxyalkyl dithiophosphates, R_1, R_2 are H or alkyl, $R_1 + R_2$ constitute at least 8 C atoms M is metal. Example, Ba di(2,4-diamyl phenoxy ethyl) dithiophosphate

Pat. No. and date issued	Inventor	Compound
2,346,808 4-18-44	Winning, W. C., and McNab, J. G.	Aliphatic alcohol of at least 8 C atoms, + metal salt of phenol or phenol sulfide, e.g. stearyl, oleyl, or lauryl alcohol—Ba salt of diisobutyl phenol sulfide
2,347,152 4-18-44	Gardiner, E. W., and Denison, G. H.	Metal salts of phenols and halogenated phenols containing more than 10 C atoms, e.g. Ca cetyl phenate, Ba cetyl phenate, Ca mono chloro amyl phenate
2,347,546 4-25-44	Finley, W. L.	Ca salt of alkyl ester of salicyclic acid with 8 to 18 C atoms in alkyl group, e.g. lauryl ester
2,347,547 4-25-44	Finley, W. L.	Same with isoalkyl ester, e.g. 2-ethyl hexyl ester
2,348,461 5-9-44	Finley, W. L., and Kirk, J. H.	Mixed Ca salt of alkyl phenol sulfide and alkyl ester of salicyclic acid, e.g. 
2,351,380 6-13-44	White, E. R.	Al salt of alpha aromatic amino mono carboxylic acid, e.g. Al alpha toluidino stearate
2,356,043 8-15-44	Finley, W. L.	Ca salt of alkyl ester of alkylated salicylic acid, e.g. Ca 2-ethyl hexyl methyl salicylate 
2,366,191 1-2-45	Jenkins, V. N.	Metal sulfonate + metal salt of alkylated diphenol sulfide + alizarin
2,366,817 1-9-45	Towne, C. C.	Phosphatide compound, e.g. lecithin, + stannous naphthenate or sulfonate
2,367,435 1-16-45	Ruedrich, P. M.	Alkaline earth soaps of sulfonic acids that have been purified by oxidation with $KMnO_4$
2,368,000 1-23-45	Cook, E. W., and Thomas, W. D.	Heavy metal salt of reaction product of P_2S_5 + mixture of higher branched chain aliphatic alcohols of at least six carbon atoms
2,371,333 3-13-45	Johnston, F. L.	Mono carboxylic acid ester of tri or tetra hydroxy alcohol having a neo carbon atom, e.g. penta erythitol tetra stearate
2,372,411 3-27-45	Van Ess, P. R., and Bergstrom, R. F.	Polyvalent metal salt of sulfonic acid, e.g. calcium salt of petroleum sulfonic acid, and polyvalent metal salt of aromatic hydroxy compound, e.g. zinc diisopropyl salicylate
2,372,588 3-27-45	Larsen, R. G., and Zublin, E. W.	Mono carboxylic salt of heterocyclic aromatic compound containing nitrogen, at least one atom of which is trivalent, e.g. pyridine and quinoline derivatives
2,372,955 4-3-45	Johnston, F.L.	Alkali metal salt of phthalic acid monoalkyl ester, e.g. sodium mono n-cetyl ester or phthalic acid
2,375,222 5-8-45	Griffin, J. R., and Van Ess, P. R.	Metal salt of condensation product of aromatic hydroxy compound and an aldehyde, e.g. calcium salt of methylene bis p-isooctyl phenol
2,375,579 5-8-45	Patterson, J. A., and McCleary, R. F.	Metal salt of thermally extracted cashew nut shell oil
2,378,820 6-19-45	Amott, E.	Mixture of soaps of mixture of green acid and mahogony acid obtained in sulfonation of mineral oil. The green acid soaps are solubilized by the mahogony acid soaps
2,379,241 6-26-45	McNab, J. G., and Watkins, W. T.	M—Y—Ar—Z_x—Q, where M is metal, Y is element from right side of group VI of periodic chart, Z is member of sulfur group, and Q is organic group. Example—cobalt salt of hydroxy tertiary amyl phenyl sulfide
2,380,531 7-31-45	Jolly, S. E.	Sulfurized nitriles, e.g. nitriles of fatty acids or rosin acids
2,383,033 8-21-45	Adams, E. W., and Flint, G. W.	Mixture of oxidation products of petroleum and soaps of sulfonic acids
2,384,511 9-11-45	Jehle, L. P.	Metal salt of 2-ethyl butyric or 2-ethyl hexoic acid

*Note: This is believed to constitute a reasonably complete coverage through December 31, 1945.

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It's Waterless

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All you do is rub a dab of OB Hand Cleaner on your hands, like ordinary soap, until grime dissolves—then wipe off on rag or paper towel. Needs no water. Cuts grease, oil, tar, creosote, paint, printers ink, Black Magic oil base drilling fluid. Soothes cuts, scratches and chapped skin. Write for free sample.

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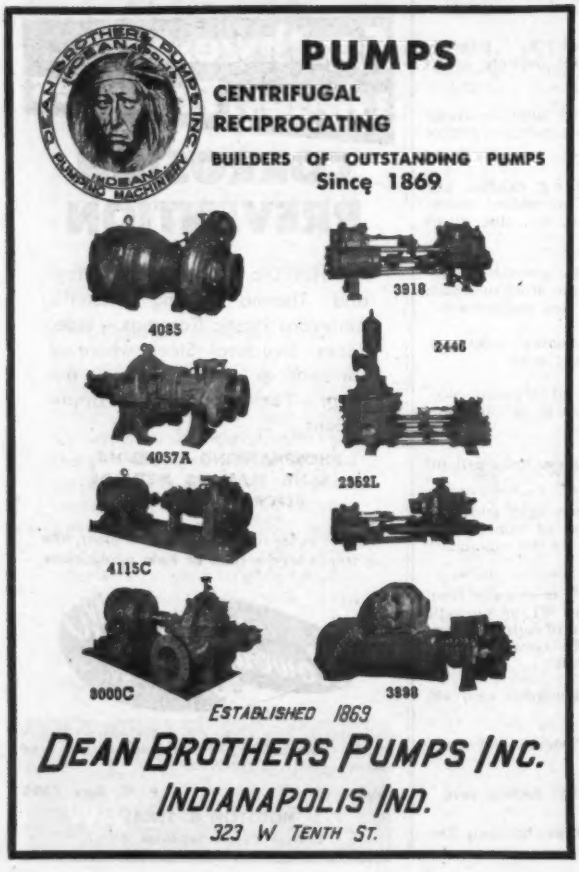
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The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Steam Flow Through Orifices

TENTATIVE SCHEDULE OF CURRENT TOPICS IN THE REFINER'S NOTEBOOK

No. 176, Dec. 27—Equivalent Lengths
No. 177, Jan. 1—Cost of Leaks
No. 178, Jan. 8—7 Pipe and Tubing Sizes (8 to 10¾ in.)
No. 179, Jan. 15—8 Pipe and Tubing Sizes (11 to 13 in.)
No. 180, Jan. 22—Steam Flow Through Orifices
No. 181, Jan. 29—9 Pipe and Tubing Sizes (13⅜ to 20 in.)
No. 182, Feb. 5—10 Pipe and Tubing Sizes (22 to 60 in.)
No. 183, Feb. 12—Viscosity of Vapors
No. 184, Feb. 19—Friction in Vapor Headers
No. 185, Feb. 26—Friction in Vapor Lines

Comments or suggestions of pertinent topics are invited from our readers but the topics must be of general interest.

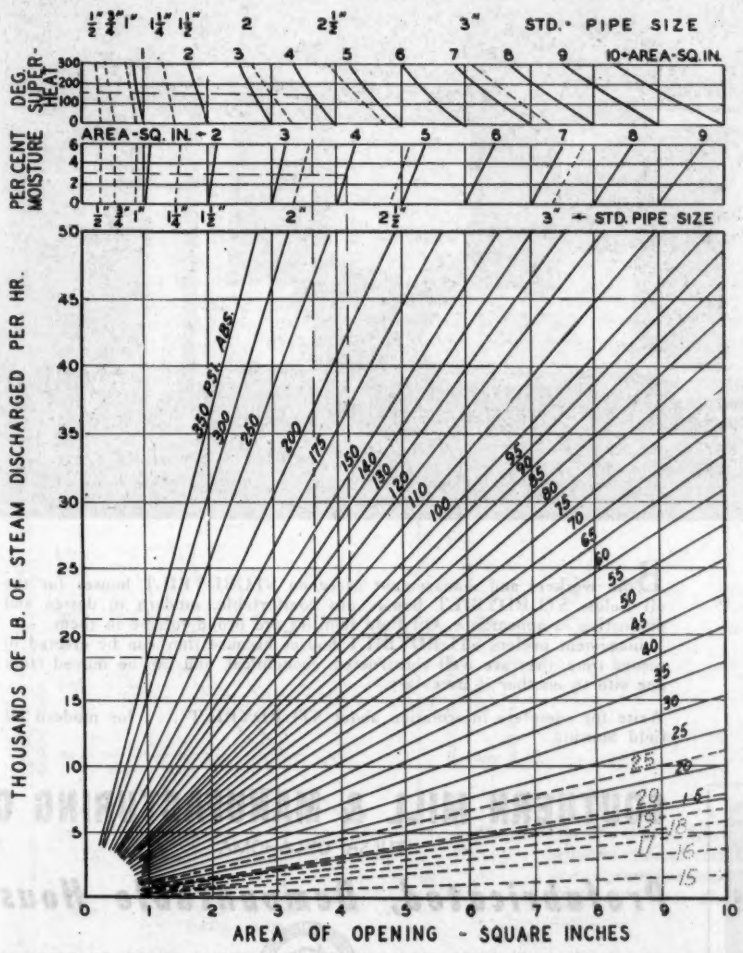
½" ¾" 1" 1¼" 1½" 2 2½" 3" STD. PIPE SIZE
DEG. SUPER-HEAT
10-AREA-SQ. IN.
AREA-SQ. IN.
PER CENT MOISTURE
STD. PIPE SIZE
THOUSANDS OF LB. OF STEAM DISCHARGED PER HR.
350 PSI. ABS.
AREA OF OPENING - SQUARE INCHES

Fig. 1—Flow of steam through short tubes and orifices. (Courtesy Crane Co.)

FLOW meters are seldom available at the many points throughout a refinery where they are needed. Steam is used in the cleaning of tanks, vessels, tank cars, coils, exchanger bundles, towers, etc., and it is used extensively in processing, for stripping, and for emergency heating of liquids. The amount of steam used for these numerous services can be estimated with reasonable accuracy by Fig. 1. This figure requires the installation of a pressure gage and an orifice or a short tube and it should be used only for lines that discharge at or near atmospheric pressure.

The chart is based on the fact that the rate of flow of steam through an orifice or restriction is a constant which depends only on the properties of the steam and the size of the opening, provided the absolute downstream pressure is less than 58 per cent of the absolute upstream pressure. Thus, the chart is not accurate if the upstream pressure is lower than:

Discharge at—	Upstream pressure (min.)
14.7 psia.	10.7 psig.
20.0 psia.	19.8 psig.
30.0 psia.	37.0 psig.
50.0 psia.	71.5 psig.

Example.—Enter Fig. 1 at the upper left at, for example, a steam containing 3 per cent moisture (97 per cent quality). Move horizontally as shown by the dotted lines to the proper orifice area (here it is 4 sq. in.) and vertically to the pressure shown on the gage. Note that the pressure is absolute pressure, i.e. gage pressure plus 14.7 at sea level. At 100 psia. the amount of steam discharged is 21,200 lb. per hour.

No. 180 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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MANUFACTURERS OF SPECIAL MILLWORK: DISTRIBUTORS OF JOHNS - MANVILLE BUILDING MATERIALS: CURTIS WOODWORK

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MODERN Rotary DRILLING

Hydraulic Transmission for Power Slush Pumps

BASIC principles of hydraulic transmissions and their application to hoisting and rotating operations of a rotary rig have been discussed previously in this series (Installments 22 and 23). A summary of pertinent information on use of hydraulic transmission in power pump service is given below.

Hydraulic Coupling

Fig. 56 shows the characteristics of a diesel engine-hydraulic-coupling arrangement used in a power-slush-pump drive. Over a considerable range of the engine speed, curve A, representing horsepower characteristics of the engine, is parallel to curve B, representing the characteristics of the coupling. This means that within this range there is really a direct-drive connection between the engine and the pump, the main advantage of the coupling being its ability to absorb shock loads and vibration. There is about 3 to 5 per cent of slip in the coupling, within this range.

A hydraulic coupling transmits the engine torque in ratio of 1 to 1. As the load on the pump increases, the engine slows down and the slip of the coupling increases. The rate of increase of the slip is higher than the rate of decrease of the engine speed and at a certain engine speed the slip becomes 100 per cent with the pump stalled. This happens within the range of efficient engine speed, as indicated in the chart by relation of the stalling speed to the engine-torque curve.

Hydraulic couplings for power-pump drives have been used for several years with very satisfactory results. Scoop tube-type couplings are used. In such a coupling the amount of fluid in the coupling may be regulated, which controls the coupling output speed for any desired torque requirements. Provisions are available for cooling the coupling fluid. This makes possible running the engine for a considerable period of time with the pump stalled without overheating the coupling.

Hydraulic Torque Converter

A converter-equipped pump adjusts automatically its speed to the pressure of the circulating system, with engine running at an efficient speed. Use of torque converters in power-pump drives represents a number of problems. At stalled output the converter develops five times the torque of the engine. This makes the possibility of overloading the pump quite real. Proper speeds must be provided to keep the converter within its efficient speed-ratio range. Within this range there is a loss of about 20 per cent in transmitting the power through the converter. Final consideration is the fact that converters are not as yet available in different sizes needed to cover the required range.

Torque converters have been used so far primarily with special-purpose pumps used for well cleaning, standard cementing operations, squeeze cementing, and others. Fig. 57 shows the speed-pressure characteristics of a 7 by 12, 220-hp. converter equipped pump used with a work-over rig. Applications to ordinary slush-pump drives are still very infrequent. A larger pump, of the same type as the one characteristics of which are shown in Fig. 57, has been recently placed in service as a slush pump for routine drilling operations.

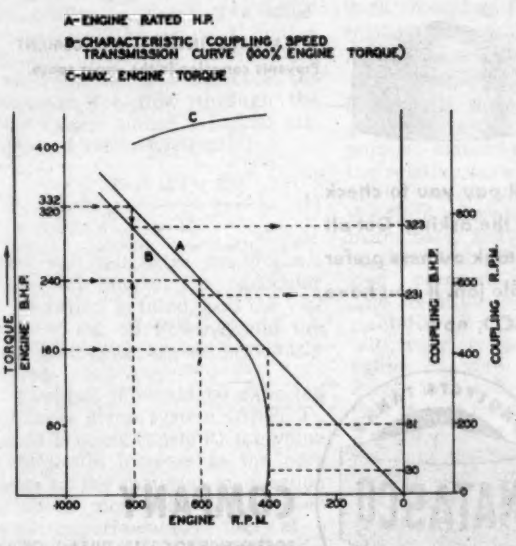

Fig. 56—(Left) Characteristics of a hydraulic-coupling-power-slush pump drive

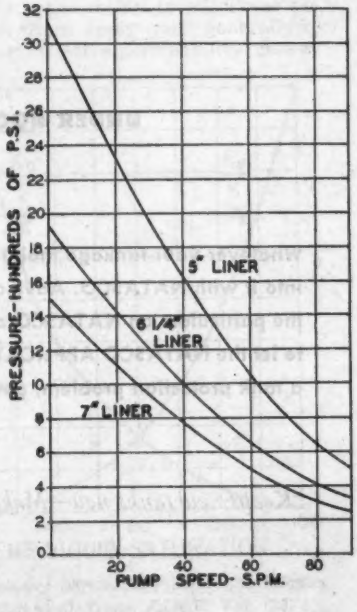

Fig. 57—(Right) Speed-pressure characteristics of a converter equipped 7 by 12 power slush pump

No. 52 in a series by Joseph Zaba, petroleum engineer, Houston

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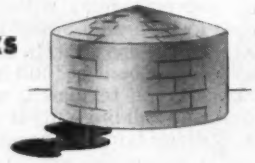

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Prevents corrosion in the vapor space.

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N 47-3

ENGINEERING *fundamentals*

Effective and Relative Permeability

IT was noted in a previous discussion that Darcy's law for flow in porous material was predicated upon the condition that the material was entirely saturated with the flowing fluid. Such a circumstance does not often exist in nature, particularly in petroleum reservoirs. Gas or oil is usually found coexistent with water, and frequently gas, oil, and water may occupy together the pores in a portion or all of a reservoir. The present discussion will outline the use of Darcy's law for flow when the fluid under consideration occupies less than all of the pore space.

Ability of a porous material to conduct a fluid when the saturation of that fluid in the material is less than 100 per cent of the pore space is known as the **effective permeability** of the material to that fluid. The effective permeability is written by using a subscript to designate the fluid under consideration. For example, k_o, k_g, and k_w mean respectively the effective permeability to oil, the effective permeability to gas, and the effective permeability to water. The effective permeability is used mathematically in Darcy's law in place of permeability. For example, the expression for flow through the linear system under a partial saturation of oil is written:

$$Q_o = \frac{k_o A (P_1 - P_2)}{\mu_o L} \qquad (1)$$

where Q_o designates the volume rate of oil flow at the particular oil saturation in mind, μ_o is the viscosity of the oil flowing, and the other quantities are as previously defined.

Of course, it would be expected that for a given system (A, P_1, P_2, μ_o, and L being constant) the value of Q_o would increase as the pore spaces of the material in question contained more oil. It has been found experimentally that at a given value of fluid saturation the value of the effective permeability to that fluid is constant. Thus, a change in effective permeability depends only upon a change in saturation. This conclusion has been tested upon specific porous systems under varying pressure differentials, varying values of interfacial tension, and varying viscosity ratios.

Effective permeability will, of course, vary from zero to the value of the permeability at 100 per cent saturation. For a given reservoir material and given fluids there is no means of predicting the effective permeability at a given fluid saturation. One must rely upon experimental measurement. No two porous bodies will necessarily have the same variation of effective permeability with saturation.

A term more useful for correlating purposes is **relative permeability.** This is defined as the ratio of the effective permeability to a given fluid at a definite saturation to the permeability at 100 per cent saturation. The terminology most widely used is simply k_g/k, k_o/k, k_w/k, meaning the relative permeability to gas, oil, and water respectively. Since k is a constant for a given porous material, the relative permeability varies with the fluid saturation in the same fashion as does the effective permeability. The relative permeability to a fluid will vary from a value of zero at some low saturation of that fluid to a value of 1.0 at 100 per cent saturation of that fluid.

Although relative permeability is strictly defined as given above, another useful definition is sometimes given as the ratio of the amount of fluid flowing at a given saturation to the amount which would flow at 100 per cent saturation, conditions of pressure being the same. By formula:

$$k_o/k = Q_o/Q$$

Likewise, the ratio of any two effective permeabilities is equivalent to the ratio of the rates of flow at the two saturations considered, pressure differentials being constant. By formula:

$$k_o/k_o' = Q_o/Q_o'$$

Relative permeability for a given system cannot be calculated but must be measured experimentally. Nevertheless, there are certain characteristics of the relationship between relative permeability and saturation which can be noted. For example, Fig. 1 shows the relative permeability to gas and oil versus saturation in a given porous material. Observe that zero permeability to oil exists at a definite oil saturation, that the sum of the relative permeabilities at a given saturation value do not add up to 1.0, that a definite gas saturation is necessary before gas will flow, and that a small amount of oil does not decrease the relative permeability to gas as rapidly as a small amount of gas decreases the relative permeability to oil. These observations apply quite generally to most relative-permeability curves.

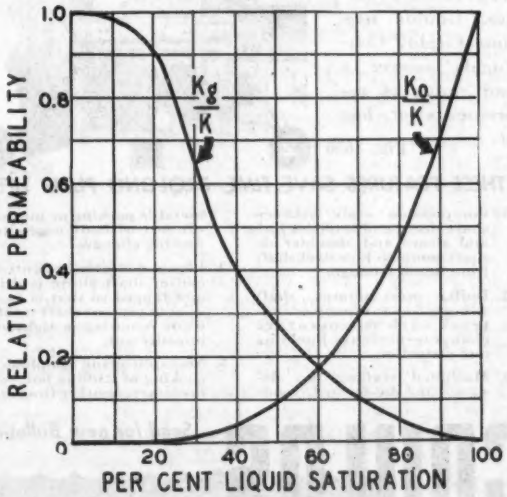

Fig. 1—A typical relative permeability saturation relationship (After Muskat et al. Trans. A.I.M.E., Vol. 123)

Series prepared by Dr. John C. Calhoun, Jr., Petroleum Engineering School, University of Oklahoma

2 NEW Goulds Pumps

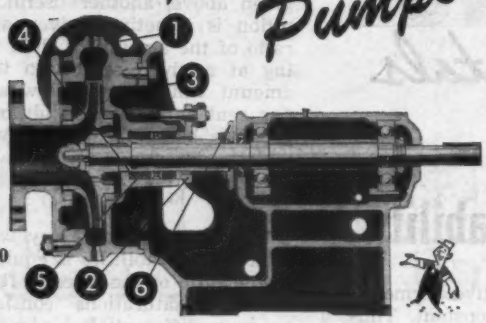

Fig. 3750

The "SUPPORT-HEAD" Centrifugal . . .

26 sizes . . . capacities to 3000 G. P. M. . . .

Extra-heavy, well proportioned construction throughout the "Support-Head" series assures trouble-free operation 24 hours per day under the most severe service conditions.

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1. Volute casing bolted to support-head with recessed lock fit to assure alignment.
2. A new split gland makes it unnecessary to unbolt gland halves when repacking stuffing box—saves time.
3. Full, open-top construction permits ready access to gland and stuffing box.
4. Shaft sleeve covers full length of shaft, completely protecting shaft from liquid damage. Shaft sleeve expands or contracts with temperature changes — prevents buckling and distortion.
5. Stuffing box is regularly provided with die-formed, semi-metallic packing.
6. Liquid deflector prevents leakage of liquid into motor bearing, prolonging life of motor.

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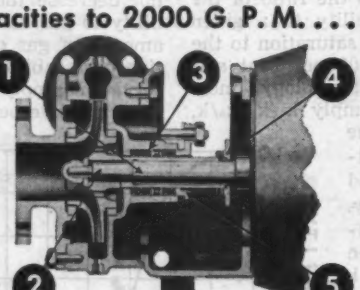

Fig. 3650

√ THESE FEATURES SAVE TIME, PROLONG PUMP LIFE:

1. Compression seals between shaft sleeve and impeller hub and sleeve and shoulder on shaft completely protect shaft from liquid damage.
2. Unlike most pumps, shaft sleeve is free to expand or contract with temperature changes—prevents buckling and distortion.
3. Machined stuffing box designed for die-formed, semi-metallic packing or mechanical seal *without* necessity of making changes.
4. Liquid deflector, mounted on end of shaft sleeve is drilled and tapped so that is can be used to prevent shaft rotation while removing or tightening impeller nut.
5. New split gland simplifies repacking of stuffing box, when necessary, another time saver.

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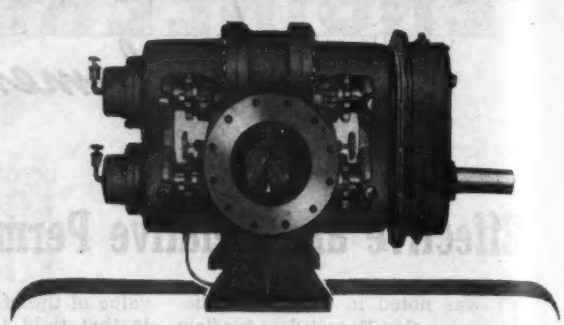

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A top performer in petroleum and general service, the Kinney Heliquad Rotary Pump delivers a continuous, non-pulsating flow — handles viscous or non-viscous liquids, cold or hot. Steel timing gears drive the steep helical angle rotors which do the pumping: the rotors do not drive each other or transmit power. Anti-friction bearings are used throughout. Thrust bearings maintain fixed clearances between rotors and heads. Stuffing box glands, with liberal packings, are readily accessible for adjustment. Pumps available plain or steam jacketed, with capacities up to 3,000 barrels per hour.

Write for Bulletin 18A

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2. Since special mounting frames are furnished to fit each vehicle, installation can be accomplished by any good garage in from 4 to 8 hours, depending on the vehicle.

3. The positive crank-shaft clutch permits quick and easy changing of fan belts without disassembling the clutch. *The Ramsey Model 101 is the only winch with a jaw-type clutch that can be disengaged under a load.*

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NATURAL GAS

FPC Authorizes Three Expansion Programs

The Federal Power Commission has granted authorization to construct facilities, totaling an estimated $2,690,164, to Home Gas Co., Manufacturers Light & Heat Co., and Cumberland & Allegheny Gas Co. The companies propose to begin immediate construction on some of the facilities.

Facilities to be constructed by Home include two regulator stations in Deer Park Town, New York, about 26 miles of 12-in. transmission line between Hancock and Cochecton, N. Y., and about 25 miles of 10-in. transmission line between Horseheads and the Dundee storage field, New York.

Manufacturers Light & Heat were authorized a 1,000 hp. compressor station and connection with Texas Eastern Transmission Corp. in Chester County, two short 14-in. connections with Texas Eastern in Greene County, a measuring and regulator station in Chester County, and an additional 375 hp. unit at the Waynesburg compressor station in Greene County.

Cumberland & Allegheny was authorized to construct 7 miles of 6-in. transmission line between Terra Alta, W. Va., and Oakland, Md.

OTS Publishing Roelen Fischer-Tropsch Report

A detailed account of the development and use of the Fischer-Tropsch process for producing synthetic fuels and lubricants as revealed by Dr. Otto Roelen, foremost German authority on the subject, is now being distributed by the Office of Technical Services of the Department of Commerce.

Roelen was associated with Dr. Franz Fischer in the discovery of the process in 1926 and with its subsequent development as a major source of fuels for Germany.

The discussion is divided into four major sections.

The first is a review of the full-scale synthesis process, including a discussion of the purification of the synthesis gas, composition, manufacture, reduction, testing, and improvements of catalysts, causes of catalyst deterioration, normal and medium pressure synthesis, and primary and secondary products.

The second section discusses research developments not yet practiced on a full scale, including an account of iron catalyst synthesis, liquid-phase synthesis, and isosynthesis.

In the third section is a discussion of the development of ruthenium catalysts and the addition of acetylene to the synthesis gas.

The fourth section deals with the OXO-synthesis and includes a discussion of propyl aldehyde production, the catalyst used, starting materials, and resulting products.

Photostat copies of the 67-page report may be obtained from OTS for $5 and microfilm copies for $2.

Acetylene Production From Methane Described

Production of acetylene from methane in a German-designed regenerative-type furnace is described in a report now on sale by the Office of Technical Services of the Department of Commerce.

The report contains information on a process worked out in Germany by Ruhr-Chemie engineers which utilizes methane as a raw material. The German process was operated successfully on a pilot-plant scale and construction of a commercial plant was planned in Hungary.

The report contains a full description of the process, including details on the reactor and purification systems, and removal of diacetylene and acetylene recovery. Raw material and power requirement figures for a plant to produce 4,000 cu. m. of acetylene per day are included.

Gulf Plans Reinjection Project in Louisiana

HOUSTON.—Gulf Oil Corp. is planning a gas-reinjection project costing approximately $4,500,000 in Quarantine Bay, Grand Bay, and West Bay in Southern Louisiana.

The facilities will be constructed as soon as equipment can be secured, according to J. H. Russell, Gulf vice president in Houston. The project will reinject between 30,000,000 and 40,000,000 cu. ft. daily which is now being flared because of a lack of a market.

The facilities will consist largely of collection systems and compressors. In Baton Rouge, La., Joseph L. McHugh, conservation commission, said the project was "another step toward the day when the flaring of natural gas will be at an absolute minimum."

Columbian Carbon Co. Buys Seagraves Plant

Columbian Carbon Co. has purchased the government-owned carbon-black plant in Seagraves, Tex., for $1,420,000 from War Assets Administration.

On a land site of 236 acres are 180 burner houses for carbon black, 17 processing buildings and 19 four-room frame houses. The gas supply line is 12½ miles of 20-in. pipe. The plant has a railroad spur running 3 miles from Seagraves to the plant and includes 1,000 ft. of switch track at the site.

The plant, which had been under lease to the Columbian Carbon Co., originally cost $2,226,179.

FPC Reports for 1946 Are Now Available

The Federal Power Commission has announced the publication of the FPC Reports, Volume 5, covering the period from January 1 to December 31, 1946.

Copies may be obtained from the Division of Publications, Federal Power Commission, Washington, D. C., or from the Superintendent of Documents, Government Printing Office, Washington, D. C., at $2.75 each.

Natural Gasoline

Keith to Head N.G.A.A. Corpus Christi Program

P. C. Keith, Hydrocol Corp., New York, will head the program of the Gulf Coast regional meeting of the Natural Gasoline Association of America, with his discussion of "Gas Synthesis on the Gulf Coast." The meeting is scheduled in the Driscoll Hotel, Corpus Christi, January 30.

Other outstanding discussions on the program are: "Hydrocarbons—What Are They?" Dr. Frank Dotterweich, Texas College of Arts and Industry, Kingsville, Tex.; "Fundamentals of Fractionation," A. J. L. Hutchinson, Fish Engineering Co., Houston; and "Inflamability of Gases," G. M. Kintz, U. S. Bureau of Mines, Dallas.

Two moving pictures will be shown: "Crude Oil Distillation," Shell Oil Co., Inc.; and "Technique of Taming Wild Wells," Cameron Iron Works.

James Doughty, Southern Minerals Corp., Corpus Christi, will serve as chairman of the program committee.

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REFINING

Continental Takes Title To War-Built Refinery

TITLE to the large 100-octane gasoline plant erected at Ponca City, Okla., by the Government during the war passed to Continental Oil Co. January 15 with delivery of a check for $2,841,507.02 to officials of the War Assets Administration by H. G. Osborn, vice president in charge of manufacturing.

Total purchase price was $3,125,000, and a partial payment was made several weeks ago.

Continental plans to spend approximately $1,000,000 to modernize the plant, according to Osborn. The work will start immediately and will include conversion of kilns to a solid-bed type, installation of equipment to permit concurrent flow of catalyst and vapor, and major repairs to other equipment.

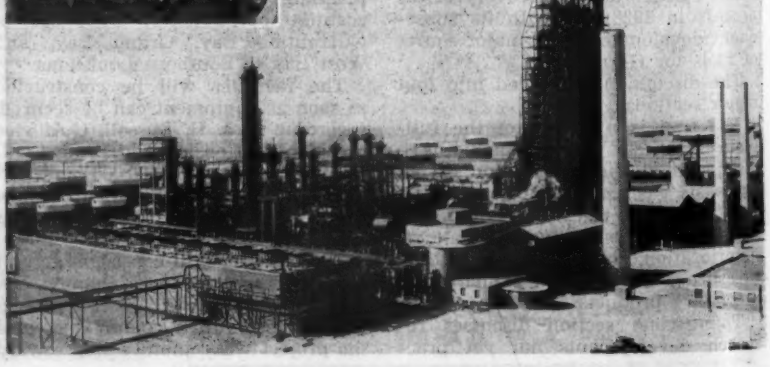
Ultramodern in design at the time of construction, the 100-octane plant includes Thermofor catalytic cracking and retreating units with a capacity for cracking of 20,000 bbl. daily of gas oil and treating 6,000 bbl. daily; feed-preparation and gas-concentration units with a capacity of 3,000 bbl. daily; an alkylation unit with a capacity of 3,000 bbl. daily; and aluminum chloride isomerization units with a capacity of 1,500 bbl. daily. In addition to the main processes, the plant is self-contained, having a control laboratory, rail trackage for simultaneous loading of 30 tank cars, storage for 240,000 bbl. of finished products and redwood cooling tower for cooling 30,000 gal. of water per minute.

As agent for the government's Defense Plant Corp., Continental supervised construction of the plant by The Lummus Co. and operated it during the war as lessee. Construction was started in August 1942 and the plant went on stream in May 1944.

During the war years Continental produced 108,600,996 gal. of 100-octane aviation gasoline at the plant and produced an additional 103,370,988 gal. of 100-octane gasoline ingredients for other plants as well as the one at Ponca City. Although Continental and several other companies previously made ingredients for 100-octane gasoline for several years, the war plant at Ponca City was the first in the state and one of the first in the Southwest to manufacture and blend 100-octane gasoline entirely in one plant.

The toluene plant, built at Continental's Ponca City refinery at the

H. G. Osborn, Continental Oil Co. vice president in charge of manufacturing (left), receives a deed to complete purchase by Continental of the huge 100-octane gasoline plant (below) erected in Ponca City, Okla. during the war by Defense Plant Corp. Purchase price of the plant was $3,125,000, and Osborn immediately announced plans by Continental to spend another $1,000,000 to modernize the plant for the manufacture of high-octane motor gasoline



same time as the 100-octane plant, also has been declared surplus but it has not been sold.

Continental Buys Corpus Christi Refinery Site

HOUSTON. — Continental Oil Co. has purchased 226.17 acres of land on the west outskirts of Corpus Christi as the site of a possible new refinery.

Final deed in connection with the purchase was filed last week with the Nueces county clerk in Corpus Christi. The entire transaction involved nine tracts of land and a consideration of $514,836.50.

Charles A. Perlitz, Jr., executive vice president of the company, said in Houston that Continental earlier had taken options on the land to acquire a suitable area in case it is decided later to build the refinery. The purchase is in line with long-range plans, and no definite decision as to construction has been made.

At the present time, Continental's only refinery in Texas is its plant at Wichita Falls.

Steam Refined Stock, Paraffin Oils Output Up

Production of paraffin oils and steam refined stock for the month of November increased, the latter more than doubling its production over the previous month, according to reports received by Western Petroleum Refiners Association from 13 reporting Midwestern refiners. Steam refined stock output for November was 36,953 bbl. as compared to the previous month of 16,656 bbl.

Bright stock production for November was 283,998 bbl., a decrease of 13,002 bbl. from the previous month. Viscous neutrals decreased from 552,212 bbl. to 532,991 bbl. for November. Production of blended oils also showed a decline in output for November, going from 581,497 bbl. for October, to 568,829 bbl. for November.

Refinery Expansion Being Completed by Envoy

Envoy Petroleum Co., Long Beach, Calif., is completing an expansion program at its refinery. Equipped to process up to 4,000 bbl. daily of crude oil, facilities at the refinery produce various grades of straight reduced asphalts and all grades of oxidized asphalts in addition to the several products from skimming operations. Major equipment involved in the refinery's expansion include a two-still oxidizing unit.

Continental Now Doubling Denver Refinery Capacity

Crude-oil processing capacity of the Denver refinery of Continental Oil Co. is to be more than doubled when construction projects now under way are completed. The plant's nominal rating is placed currently at 3,200 bbl. daily skimming capacity and 1,500 bbl. daily thermal cracking input.

After revamping operations are completed, by late summer or early fall of this year, crude-oil charging capacity of the refinery will be in the range of 6,500-7,000 bbl. daily. In addition to the revamping project, which involves only crude-oil processing equipment, a new catalytic cracker and poly unit will be installed at Denver.

Contract for the revamping operations and both of the new units, estimated to cost $3,800,000, is with Lummus Co. Scheduled completion date on all of the projects is set for September.

Continental's Billings, Mont., project, estimated to cost $8,500,000, has a design capacity of 6,800 bbl. daily of crude oil. This plant will be equipped with catalytic cracking and polymerization facilities. A desulfurization unit is also included in the plant's layout of major equipment. Jones & Laughlin Supply Co. is the contractor on this work at Billings, which is scheduled for completion in September of 1949.

Poly, L.P.G. Units Being Added to Texas Plant

Processing facilities at the Mount Pleasant, Tex., plant of Talco Asphalt and Refining Division, American Liberty Oil Co., are being expanded to include a polymerization unit and facilities for the production of liquefied petroleum gases.

A portion of the plant's L.P.G. production is to be used for blending. Currently the refinery is charging 12,000 bbl. daily of crude oil for the manufacture of various products, including asphalts and technical naphthas.

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PIPE LINES

East Tennessee Project Totals 398 Miles

The East Tennessee Natural Gas Co. project calls for the construction of a total of 398 miles of pipe of various diameters. The system is to connect with the Tennessee Gas Transmission Co. line near the Lobelville, Tenn., station; from there a 186-mile, 16-in. line would be built to Chattanooga, Tenn. From Chattanooga to Knoxville, Tenn., a 112-mile 12-in. line would be built as well as 100 miles of lateral lines of 3, 4, and 8-in. Estimated cost is $11,500,000.

The project is waiting for final approval and permit from Federal Power Commission (Docket No. 889). Preliminary approval is reported to have been given.

Following final approval, the contractor, N. A. Saigh Co., will start work on the right-of-way, crossings at rivers and highways, including the twin crossing at Tennessee River. Rock ditch will be cut in advance of the arrival of pipe which is scheduled for delivery in the summer of this year.

T.G.T. to Let Pipe Laying Contracts in February

Tennessee Gas Transmission Co. will let contracts in February for a large part of its program for laying 524 miles of 20-in. to 26-in. loops to expand the capacity of its main trunk system transmitting from Texas to West Virginia.

Construction of a 73-mile, 20-in. gas feeder line from Carthage, Tex., to Natchitoches, La., for Tennessee Gas Transmission will be completed about February 1.

The project has been delayed by bad weather and late pipe shipments. The job is being handled by Latex Construction Co., which maintains a field

Interstate Oil Pipe Line Co.'s 45-mile 12-in. Oklahoma City-Maysville, Okla., crude-oil line was completed and ready for service January 20. (Upper) Dope machine operating with four rolls: two of glass mat applied as a single application penetrating a 3/32-in. coating of coal tar enamel; two rolls of felt for a single unbonded application for the final protective wrapping. (Lower) Stringer bead welding operations in the pipe gang. Contractor for the job was Midwestern Constructors

headquarters at Natchitoches. The work is directed by F. A. Silar, superintendent, and A. E. Stremmel, office manager.

Work in Texas to Be Completed in March

Latex Construction Co. is engaged in pipe-line work in the Houston and Bay City, Tex., areas which will be finished in 2 months.

Take-up and yard reconditioning of 105 miles of 6-in., 8-in. and 12-in. near Houston for Humble Pipe Line Co. is to be completed by Latex in March. J. A. Cantrell is superintendent and J. B. Stoddard, office manager, at Houston headquarters.

Early in March, Latex will complete 42 miles of 4-in. and 12-in. gas lines for Dow Chemical Co., near Bay City, Tex., where W. H. Hayes, superintendent, and Jim Nolan, office manager, have headquarters.

Shell Lays Line In Upton County, Texas

HOUSTON.—Construction has been started by Shell Pipe Line Corp. on a new 8-in., 9½-mile line to take crude oil from the Slick-Urschel Oil Co. deep Ellenburger discovery well, 1 Alford, in eastern Upton County, West Texas.

The line will connect with Shell's trunk line to Wood River, Ill., at the Upton station. Morrison Brothers has the contract with completion expected January 25. Cost of the line, is estimated at $200,000.

Triangle Will Operate Carthage-El Dorado Line

Triangle Pipe Line Co. has completed more than half of a 40-mile, 8-in. products line now under construction between Carthage, Tex., and the Shreveport, La., area. There it will connect with existing 8-in. lines which Triangle will use for moving products to El Dorado, Ark.

These existing 8-in. lines in the Shreveport-El Dorado section of the system consist of approximately 70 miles leased from Magnolia Pipe Line Co., and a line owned by Triangle. The entire Carthage-El Dorado system will operate as a common carrier which will receive consignments of gasoline and kerosine from shippers at Carthage, Tex., Shreveport, La., and Cotton Valley. The only pumping equipment being installed on the system is a temporary engine-driven reciprocating unit at Sarepta, La. Throughput has been planned for 20,000 bbl. daily.

The project is scheduled for completion March 1. Construction of the Carthage-Shreveport section is being handled by Sheppard-Geiger Construction Co.

Triangle Pipe Line Co., incorporated in the fall of 1947, is headed by C. R. Williams, president, and Richard W. Graves, vice president and general manager. Graves came to Triangle from Chicago Corp., with which he has been connected since 1939. Both Chicago Corp. and Triangle Refineries, Inc., a marketing organization headed by J. B. Saunders, president, have an interest in Triangle Pipe Line Co. The address of Triangle Pipe Line Co. is Box 1695, Shreveport.

At El Dorado, Ark., the Triangle system will connect with the El Dorado-Helena, Ark., products system known as the Project Five line of Gulf Refining Co., which will handle shipments as a common carrier. The Project Five line was built as an emergency measure in World War II.

Kansas-Nebraska Gas Co. Seeks Expansion Permit

Kansas-Nebraska Natural Gas Co., Inc., Phillipsburg, Kans., has applied to the Federal Power Commission for authorization to construct and operate increased facilities for its gas pipe line system. Costs have been estimated at $3,130,865.

The facilities proposed include partial looping of the company's Scott

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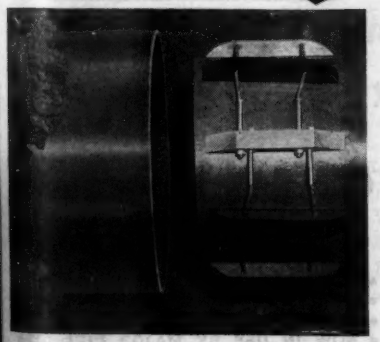

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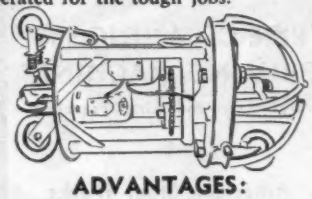

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City-Stockton-Phillipsburg and Otis-Plainville lines in Kansas, and in Nebraska the replacement of an existing line between Holdrege and Elm Creek with larger diameter pipe and construction of 35 miles of new line north of Elm Creek. Installation of one 1,000 hp. additional compressor unit at the company's Deerfield, Kans., compressor station is proposed.

Proposed capacity of the new facilities is to be about 133,000,000 cu. ft. per day. Company estimates place demand for the 1947-48 winter at 95,000,000 cu. ft. and for the 1948-49 winter at 125,000,000 cu. ft.

Utah Drops Plans for Rangely-Salt Lake Line

E. S. Holt, president, Utah Oil Refining Co., announced that his company has discontinued planning for the construction of a Rangely, Colo.,-Salt Lake City, Utah, crude oil pipe line.

Holt mentioned that Standard Oil Co. of California intends to build a Rangely-Salt Lake City line to serve its proposed refinery at Salt Lake City. Needs of the area would not justify two lines, he said.

Panhandle Eastern to Loop Extensively in 1948

Panhandle Eastern Pipe Line Co. has plans for a looping program involving the laying of 712 miles of 26-in. pipe including 357 miles of B loops and 355 miles of C loops. Construction of these loops is expected to be done in 1948 and 1949. Contracts for half of this work will be let early this summer, according to reports. The nature of these looping projects has been indicated in applications presented to the Federal Power Commission. Loops are to be laid at scattered points along the company's trunk line system.

Cable-type Pipe Line Proposed for New York

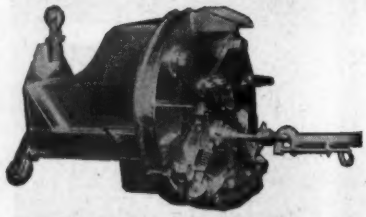
Cable-type pipe was considered last week by William O'Dwyer, mayor of New York City, for a line to be built for handling refined products in order to bypass a threatened strike on oil carrying barges and tankers in New York Harbor. The line would be laid from the New Jersey shore to New York City.

The cable-type pipe being discussed is the kind that was fabricated by General Cable Corp. for some of the lines laid across the English Channel during World War II.

O'Dwyer mentioned that Edward C. Maguire, city commissioner of commerce for New York, has been negotiating with the Maritime Commission for the release of 50 reconditioned tankers for use by major oil companies transporting fuel oil to New York.

E. A. Koenig, general superintendent, and B. D. Goodrich, chief engineer, Texas Eastern Transmission Corp., in the control room of the 20-in. station near Little Rock, Ark. An article discussing the installation of centrifugal compressors on the Texas Eastern system appears on page 60 of this issue

SUPERIOR INSIDE LINE-UP CLAMP



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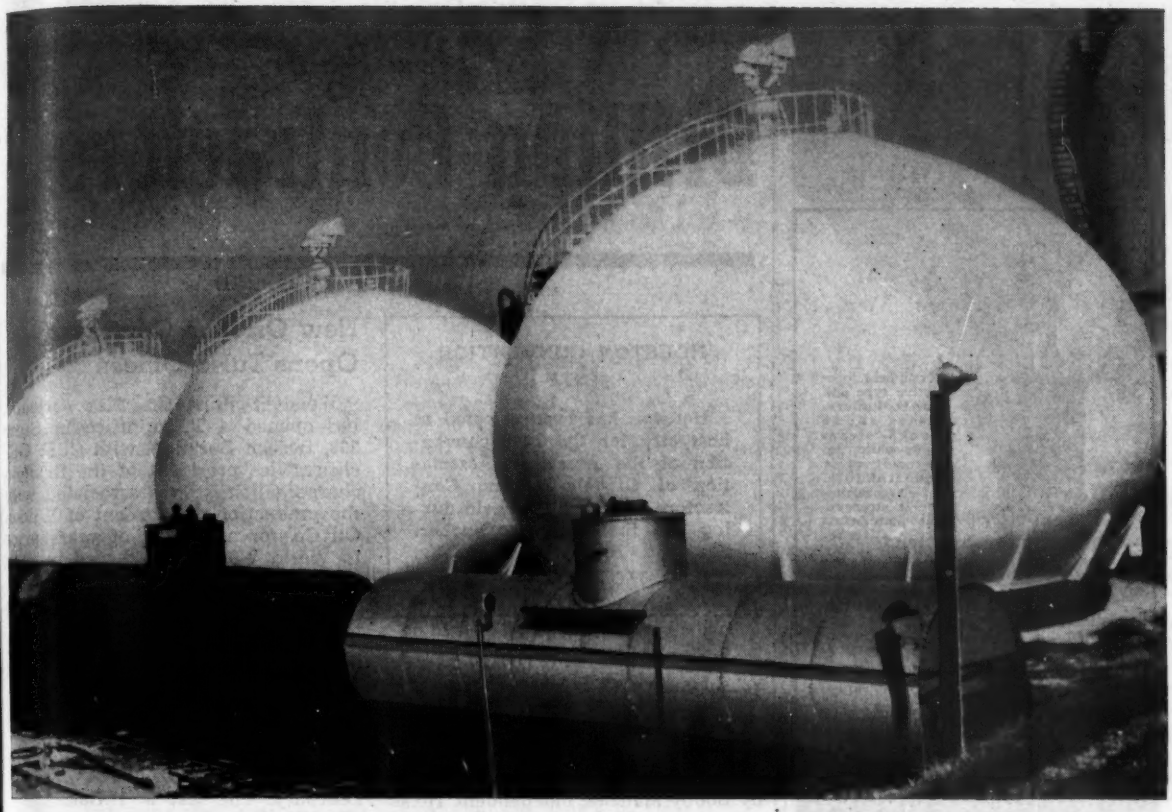

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Among the Drilling Contractors

HOUSTON CONVENTION CITY

Houston has been selected as host city for the 1948 convention of the American Association of Oilwell Drilling Contractors which will be held during the first half of October. See the News Developments section for further details.

Bobby Manziel Forms Iraq Drilling Co.

HOUSTON. — Organization of Iraq Drilling Co., with offices in Quitman and Tyler, Tex., has been announced by Bobby Manziel, independent Texas oil operator.

The company is incorporated with $100,000 stock. Manziel is president; George Mougin, Quitman, vice president; and J. G. Walker, who has been associated with Manziel a number of years, treasurer and general manager.

The company will be strictly a drilling enterprise without oil-production holdings of its own, Manziel said. Operating headquarters will be in Quitman, and other offices in Tyler.

Imperial Running Ten Contract Rigs in Leduc

Imperial Oil Co., Ltd., now has 10 contract and 2 company rigs operating in the Leduc area of Alberta, Canada. Drilling Contractors, Ltd., has four rigs running for Imperial, General Petroleums, Ltd., and Can-Tex Drilling Co. have two each, and Commonwealth Drilling Co. and Young Drilling Co. have one each.

Can-Tex is moving in rig for Imperial - Leduc 24, LSD 12, 35-50-26w4th, at the north end of the proven area. Young Drilling Co. is rigging up for Imperial-Leduc 34, LSD 9, 9-50-26w4th, north offset of the most southerly producer in the field. General Petroleums is preparing location for Imperial-Leduc 35, LSD 11, 19-50-26w4th, north offset of the field's west outpost producer. Derrick is being erected by Commonwealth for Imperial-Leduc 36, LSD 10, 21-50-26w4th, an offset to two producers.

New Orleans Contractor Opens Tulsa Offices

Woods Drilling Co., New Orleans, has opened a Tulsa office in Suite 208, Beacon Building, with C. F. Gilchrist, vice president of the firm, in charge. Gilchrist was associated with the production department of Wilcox Oil Co. for a number of years prior to World War II. He served in both world wars, emerging from the recent conflict as a full colonel in the Air Corps.

Woods drilling entered the Oklahoma oil picture this past year and started off in good shape with a fine discovery in Logan County. Woods and Wilcox Oil Co. will start a 5,000-ft. Arbuckle-lime test in northern Harmon County, Oklahoma, early in February. The test is 1 Baker, NW SW NW 20-5n-26w.

Clingman And Herndon Companies Amend Charters

Charter amendments for two drilling firms have been announced by the Oklahoma secretary of state. W. L. Clingman Drilling Co., Inc., formerly of Guthrie, has been renamed Briscoe & Clingman Drilling Co., with offices in Oklahoma City. Capital stock is $100,000 and term of existence is 20 years. Incorporators are Powell Briscoe, E. F. Briscoe, and Walter L. Clingman, all of Oklahoma City.

An amendment extension was registered for Herndon Drilling Co., Tulsa, with capital stock of $300,000 and a 20-year term of existence. Officers of the firm include H. Dorsey Douglas, president, and B. E. Rogers, secretary, both of Tulsa.

Sterling Drilling Co., Sterling, Kans., has started drilling on Neil Bogan 1 Devenpeck, NW NW NE 7-24-3w, wildcat 2 miles south of Burton pool, western Harvey County, Kansas.

Regent Drilling Co. is to start operations soon for an Alberta, Canada, wildcat, the Gulf-Piccadilly 1 Marshall, LSD 14, 16-39-21w4th, about 5 miles south of Buffalo Lake.

C. E. O'Neal, Evansville, has contract for two wells which were recently granted Indiana drilling permits. They are: J. E. Amis, Jr., 1 Mar-

garet K. Woods, NW NW NE 36-1s-12w, Gibson County, and John B. Buchman 3 Thomas Wassmer et al, SW NW 6-5s-11w, Vanderburgh County.

Bennett & Roberts Drilling Co., Inc., Wichita, has staked location for its 1 Blake, SW SW SW 9-21-5, 3 miles southeast of Bornholdt pool, southeastern McPherson County, Kansas.

J. W. Lang, Allegan, Mich., is using his own tools to drill his 1 Jacob Meckhof, NW NW SE 32-5n-12w, Kent County, Michigan.

Roger & Trail are contractors for Pacific Operating Co. 1 James J. Smith, a 1,000-ft. test, 330 ft. from south and east lines, SE SW NW, Vanderburgh County, Indiana.

Dunlap & Graham, Long Beach, have received contract to drill a test in Seal Beach field, California, for the Hellman Estate.

Mealy-Wolfe Drilling Co., Tulsa, has started its 3 Mears, SE SE NW 8-14n-5e, Lincoln County, Oklahoma.

Herb Goodpaster, Great Bend, Kans., is using his tools to drill J. M. Huber Corp. and Herb Goodpaster 1 Fulton, NW NW NE 31-20-17, wildcat 12 miles west of Ash Creek pool and 3 miles southwest of Ash Valley, Pawnee County, Kansas.

Dee Miller, Lawrenceville, Ind., is rigging up rotary for W. C. McBride, Inc., 5 Dehart, NW NW SE 9-3n-7e, Clay County, Illinois.

Del Rio Drilling Co. will use a combination of cable and rotary tools on H. R. Herrell et al of Midland, Tex., 1 W. C. Jackson Estate, Section 102, Block 8, H&GN Survey, Pecos County, West Texas. The Yates limestone test is scheduled to 1,800 ft.

James C. Collins, Mt. Pleasant, is contractor for Fred W. Craft 1 James H. Peterson, wildcat in NE NW NW 16-9n-8e, 3 miles west of Otisville field, Genesee County, Michigan.

Jackson Drilling Co., Duncan, Okla., is moving in for its 1 Bullard, NE NW NE 34-1s-8w, a 3,000-ft. test in Stephens County, Oklahoma.

Dee-Watson Drilling Co. will drill Illinois Mid-Continent Co. 1 Homer E. Hulfacher, 330 ft. from north and west lines, NE 25-1s-12w, Gibson County, Indiana. Contract depth is 2,900 ft.

Makin Drilling Co., Hobbs, N. M., headed by R. Makin, currently has four rigs active. The rigs are working for Continental Oil Co., Penrose and Stanolind Oil & Gas Co., Phillips Petroleum Co., and Tide Water Associated Oil Co.

R & S Drilling Co., Clare, Mich., has contract for Harper & Turner Oil Co. and Sohio Petroleum Co. 1 Litwiller & Brauker, Michigan wildcat in NE SE SE 24-10n-4w, Gratiot County.

Burt Mullins has contract for a rank wildcat being drilled ¼ mile due east of Inola, Rogers County, Oklahoma. Well is Curtis & Dickinson 1 Sible, CSL SW SE 4-19n-17e, and projected depth is 2,000 ft.

West-Central Drilling Co. is starting its 1 C. N. Humphrey, southeast of Section 2, Block 4, H&TC Survey, 3 miles southeast of Stamford, Jones County, Texas. Well is scheduled for a 5,000-ft. test.

Dewey Stinson, Troy, Ind., has received permit to drill his 1 Ebbert Young, 465 ft. from south and 300 ft. from west lines, SW SW 2-8s-7w, Spencer County, Indiana. Contract depth is 1,800 ft.

Santa Maria Drilling Co., Long Beach, has signed contracts with Union Oil Co. for 80-81 Newlove, Santa Maria Valley field, California.

W. E. Wyse, Allegan, Mich., will drill J. O. Mutch 1 Lewis Boylan, a Michigan wildcat in SE SE NE 30-3n-13w, Allegan County.

E. B. Clark Drilling Co., Wichita Falls, has completed a 37-bbl. producer in Joy field, Clay County, Texas. The well is 1 Childs, Block 24, J. H. Belcher subdivision, and total depth is 4,961 ft.

T. P. Pike Drilling Co., Los Angeles, will deepen Mutual Development Co. 1 LaSalle, a wildcat in Newhall area, California.

Gordon Drilling Co., Mt. Pleasant, has contract for Don Rayburn 3 Glen Goodroe, wildcat in SW NE SE 18-19n-4e, Arenac County, Michigan.

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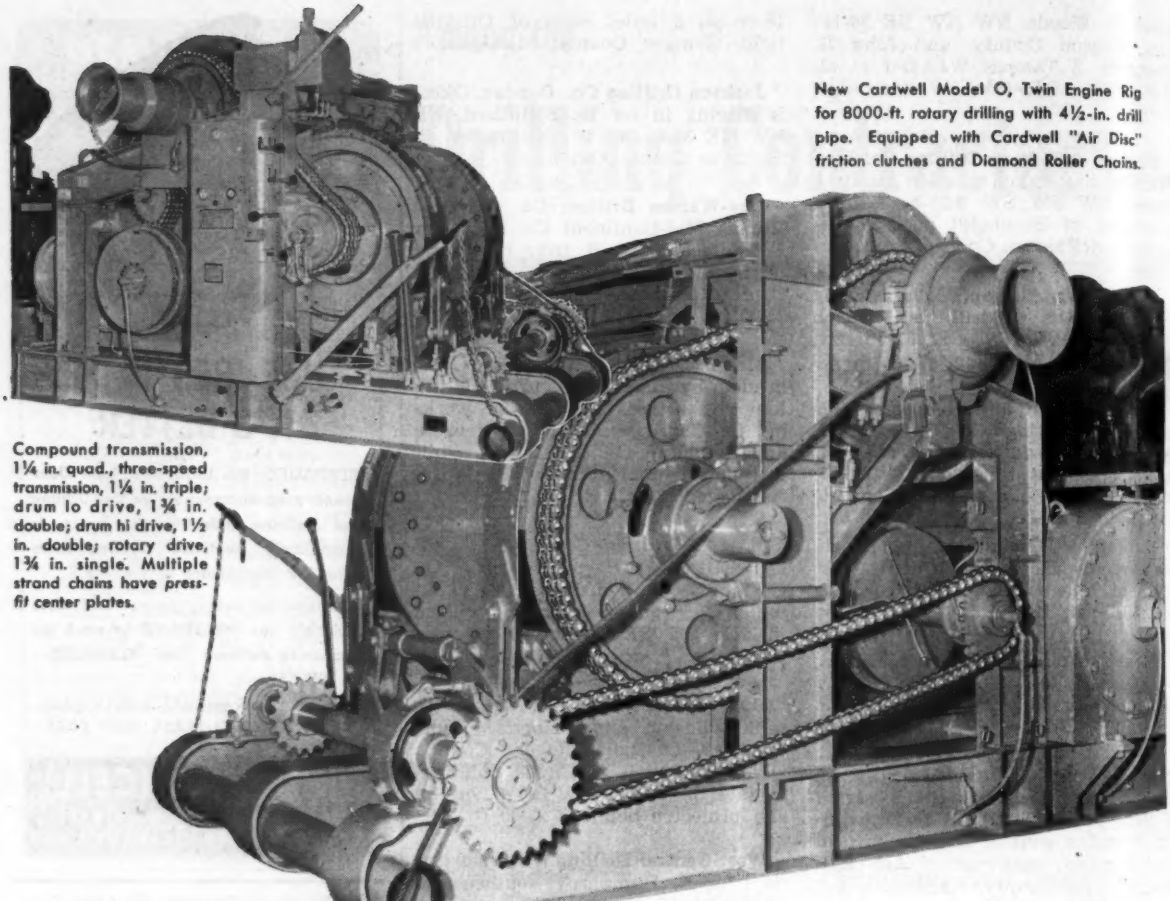

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Exploration and Drilling

Exploration Tools in 1948

THE exploration braneh of the industry faces 1948 and its problems with some known factors, some uncertain, and some definitely indeterminate. The most important known factor is that the search for new fields will not slacken during the coming year. The need for new reserves is too far from being satisfied for any lessening of effort.

Among the uncertain factors are several that might become very important. In the field of known and proven geophysical instruments, quite a few people are working on various additions: new techniques, both in interpretation and field layouts of observation stations, and new mathematical interpretation methods, plus modifications and improvements in the instruments themselves. Most of these will work, and some improvement in exploration results can be expected. The big question is how much?

In the list of definitely indeterminate factors, the big item is whether this will be the year to see a new geophysical instrument get a foothold. If various rumors are even partially true, several groups are working hard on ideas that they believe are scientifically sound, and which to them at least, seem worth while developing. The only one that seems to have been publicly discussed thus far, is the new instrument by Schlumberger, operating on relative measurements of telluric currents in sedimentary rocks. There may be others which will be heard from soon.

There is no question about the major desire of the geologists in charge of exploration. Next to an instrument that would locate oil in place by measurement of some property of the oil-saturated rock, they want a reliable method of pinning down stratigraphic pinchouts sharply, in order to lessen the cost of hunting for "strat trap" fields.

There are the usual rumors of various reputable organizations working on something that will detect oil in place by direct measurement of differences in properties. Past history and the general state of scientific development indicate the odds are greatly against any success along that line in 1948. Even if such an instrument should be developed this year, the usual pioneering difficulties in interpretation and field application would, on the basis of past experience, indicate a 2 to 3-year period of trial before the "bugs" were eliminated.

That something new will be unveiled about new developments in interpretation and use of the resistivity, or left-hand-side curve on electric logs is definite. Interest is widespread, but apparently nothing is to be revealed prior to the delivery of a paper on the subject at the A.I.M.M.E. meeting in New York next month.

Actual wildcat drilling will undoubtedly be on a larger scale than the record-breaking efforts of 1947. But whether there will be as much wildcat drilling in the deeper part of many geological basins is something else. The desire is present in geological executive circles; the money is available; but the pipe-shortage problem may cause hesitation. No one wants to find oil in a rank wildcat at 8,000 to 12,000 ft. and then not have a production string available.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

KANSAS.—Drill-stem tests indicate Ben Brack may extend Ryan pool of southeastern Rush County ¼ mile to the north. Wood River Oil & Refining Co. wildcat 1 mile east of Trapp pool, southern Russell County, is testing shows of oil encountered in Arbuckle.

ROCKY MOUNTAIN.—Phillips and Kerr-McGee open a new pay zone at Sheldon Dome, Fremont County, Wyoming, in the Tensleep formation. The California Co. is now testing at Upper Valley, important south-central Utah wildcat, in the Kaibab formation with the well scheduled to go to below 10,000 ft. In Montana, Ohio apparently has extended the Dry Creek field 1 mile to the northwest.

OKLAHOMA—Norbla Oil Co. and Sunray Oil Corp. may revive old Centerpoint pool of Pottawatomie County. Flank well of Chickasha gas field. Grady County, shows for a producer.

SOUTHWEST TEXAS.—Tide Water Associated Oil Co. has opened the deepest production in Nueces County and the deepest Frio zone production in Southwest Texas with its wildcat test ¾ mile southeast of Saxet-Deep field and 4 miles west of Corpus Christi. Discovery well flows at rate of 155 bbl. per day from 11,160-70 ft.

SOUTH LOUISIANA.—Allowable of Block 32 field discovery well, 12 miles off Point Au Fer Island of Terrebonne Parish, in the Gulf of Mexico, is increased from 76 bbl. to 400 bbl. per day due to high cost of drilling in open water.

WEST TEXAS.—Phillips Petroleum Co. opens new field 2 miles southwest of nearest Ellenburger well in Fullerton field of Andrews County. Discovery well flows at rate of 75 bbl. per hour from Ellenburger at 10,350-80 ft.

CALIFORNIA.—Continental Oil Co. encounters good oil showings below 12,000 ft. in San Emigdio area of Kern County, near southeast end of Midway-Sunset field. Showings indicate good prospects of commercial discovery. Standard of California is within a few feet of the world's depth record at its deep wildcat in Ventura County, the 1 Maxwell, 23-2n-23w.

NORTH TEXAS.—Wildcat test southwest of Halsell indicates prospects for new Simpson production in Western Clay County.

CALIFORNIA

Deep Kern Wildcat May Tap Upper Stevens Zone

LOS ANGELES.—Good oil showings below 12,000 ft. in Continental Oil Co. L-2 Kern County Land Co. in the San Emidio area of Kern County off the southeast end of Midway-Sunset field, 8-11n-21w, are indicative that the company may be on the eve of a commercial discovery in this well-regarded area. Several deep prospect wells drilled previously here have had showings of sufficient interest to justify further wildcatting.

Cores taken in the Continental well from 12,244-76 ft. are reported to have revealed 32 ft. of permeable oil sand. Subsequent formation tests have failed to bring up the oil, however, and results were equally unimpressive this week after a well scraper was run. This has occasioned some surprise in view of the sand previously cored. The operator is presently coring ahead about 30 ft. below the point at which the tests were made. The horizon tested is believed to be the upper Stevens equivalent and it is now the operator's intention to take in more of the Stevens before making further tests.

Standard Oil Co. of California has released completion data on its Kettleman Hills Middle Dome Eocene discovery well, 73-30V in 30-23s-19e, indicating an exceptionally good well, but the company is inclined to watch its performance for several weeks before coming to any decision in regard to further drilling. The oil was turned to the tanks last week at a daily rate of 600 bbl. of 47.2°-gravity oil and 5,000,000 cu. ft. of gas through a 3/8-in. choke, with 2,000 lb. flow pressure. Six days later the well was making 530 bbl. through the same sized choke with pressure about the same and gas production a little higher.

Standard of California's 1 Maxwell in the Montalvo area of Ventura County, 23-2n-23w, is drilling within a few feet of the world's depth record of 17,823 ft. It is reported that no oil showings of importance have been encountered but that the company will continue drilling as long as it feels there is a reasonable chance of discovering oil or gas in commercial quantities. The Montalvo Chamber of Commerce is planning a celebration if the record is broken. The well is being drilled by Rocky Mountain Drilling Co. It is a perfect job to date, with no delays due to fishing jobs or other causes.

Los Nietos Co. has spudded 1 East Long Beach Community in 33-4s-12w, which will explore for oil by slant drilling under a residential section of East Long Beach. The area is zoned against surface drilling operations, and the drill site is at the southeast end of Signal Hill. Should a discovery result the field will be developed entirely by slant drilling. The leased area covers about 210 city blocks and comprises 1,048 acres.

Pongratz Petroleum Co. has extended production a few hundred feet at the northwest end of the Mountain View field by the completion of 1 Winters in 13-30s-28e. The well is producing 80 bbl. a day of 20°-gravity oil on the pump from the Santa Margarita sand.

CALIFORNIA WILDCAT FAILURES

Santa Barbara County, Orella area: Shell Oil Co., Inc., 2-2 Careaga, 36-5n-31w, dry, elev. 746 ft., TD 4,887 ft.

Colusa County, Meridian area: Honolulu Oil Corp. 1 Honolulu-Barnsdall Unit, 23-15n-1w, dry, elev. 60 ft., TD 4,268 ft.

Fresno County, Priest Valley area: J. Walter Van Atta, and Associates, 1 Van Atta, 29-20s-13e, dry, elev. 2,253 ft., TD 2,294 ft.

Kern County, Fruitvale area: Superior Oil Co. 88-14 Dougherty, 14-29s-27e, dry, elev. unknown, TD 7,715 ft.

Grapevine area: Drilling & Production Co. 45-19 Reserve, 19-11n-18w, dry, elev. 731 ft., TD 3,565 ft.

Kern River area: Charles B. Webster 1-36 Cauley, 36-28s-27e, dry, elev. 635 ft., Gray oil sand, 1,552-74 ft., TD 1,717 ft.

San Emigdio area: Apex Petroleum Corp., Ltd., 2 Los Lobos, 5-10n-22w, dry, elev. 1,591 ft., TD 1,970 ft.

EASTERN TEXAS

Lower Pettit Test Shows Small Result on Acid Test

DALLAS.—In San Augustine County, D. H. Byrd 1 Blount, 3½ miles west of San Augustine, continued testing through perforations in the lower Pettit between 8,468-90 ft., with little results. Operators had retreated between 8,520-70 ft., under 2,200 psi. maximum pressure, and swabbed acid water and wash water with a slight amount of oil, for several days. Tubing was pulled and plug set at 8,510 ft., and perforations made at 8,468-90 ft. In treating, the formation broke under 1,900 psi. On the first trips of the swab there was acid water, with a small amount of gas. Swabbed down to 7,000 ft., the recovery was acid water and a slight amount of oil. Under casing pressure of 1,100 psi., it kicked off to flow a small amount of gas, with a very small stream of acid and wash water, through open 2-in. tubing. Casing pressure decreased to 350 psi.

In Cass County, 1 mile west of Avinger, J. C. Turner 1 S. Hines had total depth at 4,040 ft. in shale with streaks of sand, and was attempting a third drill-stem test with packer at 3,995 ft. Electric log to 3,770 ft. showed a kick around 3,550 ft., and again at 3,612-18 ft., indicating fair porosity and possibly salt water at the latter depth. Top of the Blossom sand was 3,295 ft., with second Blossom sand at 3,564 ft. Shell Oil Co., Inc., 1 Gerald Smith, deep test 2½ miles west of Bloomburg, was drilling in hard sand and shale at 9,520 ft.

Steve D. Ford 1 J. G. McLen, Woodbine sand wildcat 6 miles southwest of Elkhart, in Anderson County, topped the Pecan Gap chalk at 3,785 ft., and was drilling below 4,830 ft. in shale. It was the driller's top, and on that basis, the well is said to be approximately 50 ft. high to Byrd-Frost, Inc., 1 M. L. Marsh, ½ mile to the east. The chalk was some 490 ft. high to B. T. Royalties Co. 1 Coleman, 1 mile to the south. Both the Coleman and Marsh wells were dry in the Woodbine. Three miles east of Kickapoo field, O. W. Killam 1 L. C. Peterson estate, was a new test and had progressed below 1,700 ft. on latest report.

Arrow Drilling Co. and Sells Petroleum Co. 1 Allen, Evans Survey, west outpost to the Longwood field, Harrison County, had only slight shows of gas in the P limestone. Cores at 5,701-19 ft. recovered 3½ ft., being 6 in. of fragments showing slight porosity, 1 ft. of hard shale, and 2 ft. of hard shaly crystalline lime. Cores at 5,685 ft. showed slight odor in hard, dense lime. The slight show of gas was on a drill-stem test from 5,688-5,718 ft., with the tool open 30 minutes. There was little surface pressure.

In Henderson County, Continental Oil Co. 1 Henderson, 5 miles southwest of La-Rue, had no shows in drilling below 9,386 ft. Lindsay Gauntt, 1½ miles north of Athens, was drilling below 5,268 ft. in lime and shale. It topped the Georgetown lime at 5,227 ft., on an elevation of 519 ft.

EAST TEXAS (DISTRICTS 5 AND 6) WILDCAT FAILURES

Cherokee County: Hunt Oil Co. 1 Lela Tucker, Thomas Quevado Sur., 1 mi. N Jacksonville, dry, TD 4,948 ft., Pecan 3,720 ft., Austin 4,715-4,870 ft., Woodbine 4,946 ft., elev. 626 ft.

Harrison County: W. C. Feazel 1 George Bishop, Henry Harper Sur., 6 mi. N. Elysian field, dry, TD 6,504 ft., Massive anhydrite 4,850 ft., Hill 5,185 ft., James 5,612 ft., Pettit 5,930-6,025 ft., Travis Peak 6,215 ft.

Leon County: Lloyd H. Smith Exploration Co. 1 John Busby, Maria Marquez Lge., 4 mi. NW Marquez, dry, TD 7,420 ft., Austin 4,350 ft., Eagleford 4,800-32 ft., Woodbine 5,528-5,557 ft., Goodland 6,762 ft., elev. 403 ft.

McLennan County: J. T. White 1 Arthur J. Crow, Thomas De La Vega Sur., 3 mi. E Waco, TD 650 ft., no shows.

SOUTH LOUISIANA

St. Landry Parish Gets First Commercial Producer

NEW ORLEANS.—The Texas Co. 1 Lottie Land & Development Co., 25-6s-8e, wildcat, Pointe Coupee Parish, 3 miles west of Lottie and approximately 6 miles northeast of the Krotz Springs field in St. Landry Parish, has opened first commercial production for the parish. The well was drilled to 10,500 ft., and 7-in. casing set at 9,695 ft. with 5-in. line at 9,506 ft. to 10,509 ft. The well flowed 225 bbl. of 53°-gravity condensate daily through a 10/64-in. choke with a tubing pressure of 2,025 psi. Production is through perforations at 10,188-10,228 ft. Operators are continuing to test.

A potential flow gage has been reported for Texas Co. 1-C Lafourche Basin Levee District, new sand producer at Bay De Chene field, Jefferson Parish, 20-19s-24e. The well flowed 146 bbl. of 35.9°-gravity oil per day through a 5/32-in. choke, through perforations at 10,768-96 ft. Flowing pressure on tubing was 2,650 psi., and is showing 0.2 per cent basic sediment cut. Total depth is 11,940 ft.

New production for Beauregard Parish is indicated at the Magnolia Petroleum Co. 1 Four C. McPherson, 26-5s-8w, wildcat 5 miles east of Longville and 8 miles northeast of Bear field. On a drill-stem test at 8,896-8,902 ft. the well flowed at the rate of 47 bbl. of 55°-gravity condensate daily through 1/4-in. and 1/4-in. chokes. Working pressure was 890 psi. Previously the well logged sand showing some oil at 8,415-45 ft.

Sohio Petroleum Co. and General Crude Oil Co. 1-B Sweet Lake Land & Oil Co., 30-10s-6w, wildcat 2 miles east of Holmwood field, Calcasieu Parish, is making a drill-stem test at 10,776-78 ft. after setting 7-in. pipe at 10,823 ft.

A new deep gas-condensate-bearing sand now produces at Holmwood field in Calcasieu Parish. Sohio Petroleum Co. 1 Farmers Land & Canal Co.-Mallet Unit 1, 35-10s-7w, was drilled to a total depth of 12,001 ft., and on initial test through perforations at 10,820-40 ft., it flowed at the rate of 30 bbl. of condensate and 3,000,000 cu. ft. gas per day through a 10/64-in. choke. Flowing pressure is 3,600 psi. and gravity of fluid is 52.5°.

The 11 new locations reported this week included only 1 wildcat start in Cameron Parish. Golden Meadow field in Lafourche Parish received the greatest activity with four new locations reported. Two successful exploratory wells opened new pays in Holmwood and Bay De Chene pools, while two wildcats were completed dry, one each in Cameron and Plaquemines parishes.

SOUTH LOUISIANA SUCCESSFUL WILDCATS

Calcasieu Parish: New gas-condensate sand Holmwood pool—Sohio Pet. Co. 1 Farmers Land & Canal Co.-Mallet Unit 1, 35-10s-7w, TD 12,001 ft., top sand 10,830 ft., perf. 10,820-40 ft., IP: 30 bbl. condensate per day and 3,000,000 cu. ft. gas per day, through 10/64-in. choke, GOR 100,000, TP 3,600 psi., grav. 52.°, no water.

Jefferson Parish: New oil sand, Bay De Chene pool—The Texas Co. 1-C Lafourche Basin Levee District, 20-19s-

24e, TD 11,940 ft., top sand 10,768 ft., perf. 10,768-796 ft., IP: 146 bbl. oil per day through 5/32-in. choke, GOR 7,945, TP 2,650 psi., grav. 35.9°, 0.2 per cent water.

SOUTH LOUISIANA WILDCAT FAILURES

Cameron Parish: Humble Oil & Refg. Co. 1 State, Calcasieu Lake, Lease 1256, in the lake, 13s-9w, dry, TD 14,533 ft.

Plaquemines Parish: S. W. Richardson, Inc., 3-C Delacroix Corp., 35-14s-12e, dry, TD 11,900 ft.

TEXAS GULF COAST

New Shallow Sand Found In South Hutchins Field

HOUSTON.—A new shallow sand discovery in South Hutchins field, Wharton County, Adams & Haggarty 1 Kenneth A. Meek et ux, reports a potential gage of 1,730,000 cu. ft. of dry gas per day through perforations at 3,205-11¼ ft. Total depth is 5,924 ft., and gas shows were encountered from 3,200-80 ft. Flowing pressure is 1,245 psi. on tubing.

W. C. McBride, Inc., et al 1-B W. A. Stockton, prospective oil discovery well for "Charco" field, 2 miles southwest of the town of Charco in western Goliad County, was making additional perforations in the same zone after initial tests in the perforations at 4,590-95 ft. in the Yegua zone had failed to yield a steady oil flow. On drill-stem test the well had flowed at the rate of 3 to 4 bbl. of pipe-line oil per hour through 20 perforations at that level, but on completion attempt the well flows for a while, then dies. This well is located in the Victor Blanco Grant, A-7, approximately 3 miles north-northeast of the Hord's Creek-Wilcox field.

Continental Oil Co. 2-A Kittie West Scheiner, extension test 1½ miles southwest of the Kittie West gas-condensate field of Live Oak County, has set 6-in. casing on bottom at 7,503 ft. for completion in the Wilcox zone as a gas-condensate well. Drill-stem test in the Slick sand at 6,744-54 ft., using a 3,000-ft. water cushion, started flowing in 9 minutes, with 800 psi. working pressure, and recovered 552 ft. of the water cushion and 368 ft. of gas-cut mud. The Luling sand was cored showing water at 6,865-75 ft., and the well was drilled ahead to the Mackhank and Massive zone. It is located in the D. R. Fant Survey 6, 3 miles south of Kittie.

Production at Jergins field of Chambers County has been extended eastward with completion of Kirby Petroleum Co. 5 Kirby Petroleum Co., Tract 20, in the C. Smith Survey. This well is flowing into tanks making pipe-line oil and is taking potential flow. Total depth is 6,483 ft., with 5½-in. production liner cemented on bottom and perforated with 36 shots from 6,422-36 ft.

Humble Oil & Refining Co. 2 Anna B. Taylor et al, ½-mile south extension to Sugar Valley field, Matagorda County, is preparing to test for production after a squeeze job through 12 perforations at 9,991-94 ft. Total depth is 10,500 ft., and 5½-in. casing is cemented at 10,197 ft.

Phil Harris and Alice Faye 1 Sue Hill et al, wildcat in the Evergreen area of San Jacinto County, Vital Flores Survey, tested gas from Cockfield sands. The test 4 miles west of Mac Drilling Co. 1 Payne, Evergreen field discovery, and 5 miles south of Evergreen townsite. Total depth is 4,474 ft. with 5½-in. casing cemented on bottom. Perforations for a test were made at 4,376-85 ft. where it flowed gas through ¼-in. chokes with 400 psi. working pressure.

There were 15 locations reported for District 3, including 5 wildcat starts, 1 each in Brazoria, Chambers, Harris, Liberty, and Montgomery counties. The 15 new locations for District 2 included 9 wildcat starts, 3 in Calhoun, 2 each in Bee and Victoria, and 1 each in Goliad and Live Oak counties. Three successful exploratory wells were completed opening two new gas pays, one each in South Hutchins pool, Wharton and Fagan pool, Refugio County, while one new oil pay was opened in Hord's Creek pool, Goliad County. Ten wildcats were dry, two each in Fort Bend and Wharton counties, and one each in Brazoria, Calhoun, Jefferson, Lee, Live Oak, and Polk counties.

GULF COAST TEXAS—DISTRICTS 2 AND 3—SUCCESSFUL WILDCATS

Goliad County: New oil pay Hord's Creek pool—Brown & Wheeler 1-A J. R. Kauffman, in P. Trevino Grant, old well drilled deeper, original TD 4,544 ft., drilled to 5,148 ft., perforations 5,062-72 ft., IP: 133 bbl. oil per day through ⅛-in. choke, TP 1,80 psi., casing sealed, grav. 48°, no water.

Refugio County: New gas pay Fagan pool—C. L. Norsworthy, Jr., et al 1-B C. T. Holeman, in Michael Reilly Sur., top pay 2,354 ft., TD 6,035 ft., perf. 2,354-63 ft., IP: 14,500,000 cu. ft. gas per day on open flow (dry gas), shut-in pressure 1,015 psi., no water.

Wharton County: New gas pay South Hutchins pool—Adams & Haggarty 1 Kenneth A. Meek et ux, in I&GN Sur., TD 5,924 ft., perf. 3,205-11¼ ft., IP: 1,730,000 cu. ft. gas per day through ¼-in. choke, open flow 38,000,000 cu. ft. gas per day, TP 1,245 psi., shut-in pressure 1,290 psi., dry gas.

GULF COAST TEXAS—DISTRICTS 2 AND 3—WILDCAT FAILURES

Brazoria County: Hogg Oil Co. 1 Laura. Bishop, J. H. Bell Sur., ¾ mi. off SW flank production at West Columbia, dry, TD 6,380 ft.

Calhoun County: Salt Dome Oil Corp. 1 State Tr. 147, in Matagorda Bay, on State of Texas Tract 147, 5½ mi. NE of Port O'Connore, dry, TD 5,752 ft.

Fort Bend County: Callery & Hurt 1 Jerome D. Kubala, in G. Cole Sur., 4 mi. NW of Beasley townsite, dry, TD 5,761 ft.

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Sur., west of Beasley field production, dry, TD 6,006 ft.

Jefferson County: Sun Oil Co. 2 McFaddin Tr. et al, P. Humphreys Sur., Spindletop area, on NE flank of dome, dry, TD 8,500 ft.

Lee County: Gust H. Krogseth, Tr. 1 D. I. Crow, David Hudson Sur., 1 mi. S of Tanglewood townsite, dry, TD 6,410 ft.

Live Oak County: Henderson Coquat 1 Geo. West Est., in J. Pointevent Sur. 1, 2 mi. SW of Geo. West, dry, TD 8,471 ft.

Polk County: Christian & Harris 1 Lynn P. Atmar Est., R. Lynch Sur., 2 mi. W. of Onalaska townsite, dry, TD 2,525 ft.

Wharton County: Seaboard Oil Co. of Delaware et al 1 F. E. Appling, in E. L. Wilson Sur., 1 mi. SW of El Campo field prodn., dry, TD 7,510 ft.

Sinclair Prairie Oil Co. 1 Hawes Est., in Eli Hunter Sur., dry, TD 7,270 ft.

N. CENTRAL TEXAS

New Producer Seen In Western Clay County

WICHITA FALLS.—New Simpson, middle Ordovician, production for western Clay County at S. D. Johnson and Acme Die & Machine Co. 1 Fred Wines, Lot 4, Block 1, Clark & Plum Survey, 3 miles southwest of Halsell, was indicated when the wildcat recovered oil on drillstem tests. It topped the Mississippi limestone at 5,910 ft., Simpson at 5,990 ft., and the Ellenburger at 6,087 ft. Drill-stem test from 6,055-6,105 ft., total depth, had gas to the surface in 10 minutes, and in 50 minutes the total recovery was 3,150 ft. of fluid, testing half oil. Bottom-hole pressure was 1,750 psi. The test was thought to include the lower Simpson and all of the Ellenburger.

A later test of the Ellenburger between 6,091-6,105 ft., open 50 minutes, recovered only 2,500 ft. of salt water. A packer was then set at 6,035 ft., and 6,087 ft., for a test of the Simpson alone. With the tool open 1 hour and 35 minutes, gas came to the surface in 10 minutes, and the recovery was 900 ft. of oil, with no water. Bottom-hole pressure was 1,750 psi. Operators were setting casing to bottom of hole. The well had also shown for possible production in the Mississippi limestone between 5,910-20 ft., where a drill-stem test recovered some 600 ft. of oil and 400 ft. of salt water.

In northwestern Montague County, Continental Oil Co. 1 Miller, Block 21, Limestone County School Lands, and 1 mile west of Stoneburg, indicated flowing oil in Bend conglomerate between 6,127-35 ft. Top of the Caddo section was 6,053 ft. A drill-stem test at the above interval had gas at the surface in 3 minutes, and flowed oil in 14 minutes. It was shut in and not allowed to flow. Recovery, on breakdown of pipe, was 850 ft. of oil and 5 ft. of heavily oil-cut mud, with no water. Bottom-hole pressure was 2,525 psi. Operators were to test between 6,135-51 ft.

A new Strawn sand pay in Humble-Stubblefield field of southeastern Throckmorton County was reported this week at Fred M. Manning, Inc., 3 Stubblefield-Letwin, Block 991, TE&L Survey. Sand showing oil was drilled from 2,961-71 ft., and a 1-hour drill-stem test of the interval recovered 110 ft. of mud. Deepened 10 ft. and again tested, it recovered 300 ft. of oil and 180 ft. of heavily oil-cut drilling mud. Operators set casing to 2,962 ft. for completion.

One-half mile southeast of the 3 Stubblefield-Letwin, in the same field, the same operators found a lower sand pay at their 1 Graham-Letwin, Block 992, TE&L Survey. It drilled oil shows from 3,205-27 ft., and on a 30-minute drill-stem test had gas to the surface in 4 minutes, and flowing oil in 30 minutes. Recovery was 900 ft. of oil and 180 ft. of salt water. Bottom-hole pressure was 1,600 psi. Operators were to deepen before making further tests.

In northwest Wise County, A. R. Dillard 1 Younger, Block 9, Falls County School Land, and 2 miles northwest of Park Springs, was shut down to compute survey, run to total depth of 6,002 ft.

Reports indicated another Wise County test, to be drilled by Howell Brothers, Wichita Falls, would be started by February to fulfill drilling obligation. Exact location has not been made, but it was understood to be on a block comprising approximately 3,000 acres, extending from the northwest corner of Bridgeport, 4 miles northwest to and including the C. N. Metcalf survey. Contract depth was reputed to be 6,000 ft.

Dwight Ross Drilling Co., Wichita Falls, also had a block of the same size southeast of Bridgeport, but it carries no drilling obligation and the company has indicated it will await development. More than 500,000 acres of land have been leased, according to reports, since Cities Service Oil Co. 1 Manning found oil in the Bend conglomerate. Cities Service is a large acreage holder, with Phillips Petroleum Co. and Mid-Continent Petroleum Corp. also participating.

NORTH TEXAS (DISTRICT 9) SUCCESSFUL WILDCATS

Young County: Nu-Enamel Oil Corp. 1 R. L. Morrison, Sec. 465, TE&L Sur., 6 mi. NW Graham, flowed 129 bbl. 43°-gravity oil per day, Caddo 4,632-51 ft., TD 4,651 ft., 8/64-in. choke, casing pressure 550 psi., tubing pressure 100 psi., GOR 250 cu. ft.

NORTH TEXAS (DISTRICT 9) WILDCAT FAILURES

Baylor County: P. P. Langford, Jr., et al 1 Claude Cowan, Blk. 91, T&NO Sur., 1½ mi. S. Fulda, dry, TD 3,025 ft., Reef lime 2,744 ft.

Wilbarger County: Nu-Enamel Oil Corp. 1 C. F. Mock, Sec. 23, Blk. 11, H&TC Sur., 2 mi. NE, Round Timber, dry, TD 7,748 ft., Canyon 4,390 ft., Ellenburger 7,490 ft.

Wise County: A. R. Dillard 1 M. T. Younger, Sec. 9, Falls County School Lands, 2 mi. NW Parks Springs, dry, TD 6,002 ft., broken conglomerate with shows of oil 5,748-58 ft. and 5,791-92 ft.

WEST CENTRAL (DISTRICT 7-B) TEXAS SUCCESSFUL WILDCATS

Brown County: G. C. English 2-A F. H. Madison, Blk. 10, Juan Delgado Sur. 789, 10 mi. E. Cross Cutt, flowed 104 bbl. 41°-gravity oil per day, Caddo 2,078-2,102 ft., ¾-in. choke, casing pressure 650 psi., tubing pressure 250 psi., GOR 5,650 cu. ft.

Shackelford County: Humble Oil & Refining Co. 1 P. W. Pitzer, Sec. 507, TE&L Sur., 8½ mi. NE Albany, pumped 63 bbl. oil per day, Mississippi 4,510-95 ft., TD 4,566 ft., 41.5°-gravity.

Throckmorton County: J. H. Snowden 1 F. Marrs, Sec. 289, BBB&C Sur., 1½ mi. SE Throckmorton, pumped 66 bbl. oil per day, Mississippi 4,724-34 ft., TD.

J. H. Snowden et al 1 T. J. Wright, Sec. 294, BBB&C Sur., 2½ mi. SE Throckmorton, flowed 192 bbl. oil per day, ¼-in. choke, Mississippi 4,744-84 ft., casing pressure 140 psi., tubing pressure 110 psi.

MICHIGAN

Cold Weather Slows Operations

SAGINAW.—Slowed by snow and bitter cold, Michigan oil and gas field operations are severely curtailed. Only 10 completions for the week were reported, with 7 new locations. Two more heavy producers in the Kimball Lake field of Newaygo County accounted for all but 75 bbl. of the 3,233-bbl. new potential from the week's five producers, which included small wells in Bay, Ogemaw and Van Buren counties. Four of the five dry holes were wildcats. An oil show in a Monterey-Allegan wildcat was acidized for 5 bbl. a day, but was

plugged after heavy salt water encroachment.

The new starts included two in Newaygo County, one each in Ionia, Van Buren, Bay, Mecosta and Crawford counties.

MICHIGAN WILDCAT FAILURES

Allegan County, Monterey Township: Wayne C. Prather 1 Henry Reinart, SW NW NW 10-3n-13w, dry in Traverse lime, TD 1,675 ft.

Bay County, Kawkawlin Township: Chapman Oil Co. 1 W. Lambert, NW SE NW 5-15n-4e, dry in Berea, TD 1,940 ft.

Gratiot County, New Haven Township: Harper & Turner Oil Co. and Sohio Petroleum Co. 1 G. E. Litwiler and J. B. Brauker, NW SE SE 24-10n-4w, dry in Marshall, TD 1,011 ft.

Van Buren County, Covert Township: Norman L. Stevens 1 B. Lucker, SW NW SE 22-2s-17w, dry in Traverse lime, TD 1,002 ft.

LA.-ARK.

Applications Pending For Underwater Surveys

SHREVEPORT.—Carter Oil Co. 1 Conway Gandy, 28-19n-7w, reported a slight show of gas from 10,319-10,430 ft., and recovered 400 ft. of mud slightly cut with gas. The drill-stem test was made through ¼ and ⅜-in. chokes, top and bottom, and 3,000 ft. of water cushion. There was no surface pressure. The same company's 1 Marvin Mathews, 22-18n-4w, south of Hico-Knowles field in Lincoln Parish, was fishing for part of the casing string which parted around 6,843 ft. In 21-20n-3w, W. C. Feazel 1 C. C. Barham Unit, was drilling below 7,774 ft. in hard sand and shale, identified as the Travis Peak. Electric log was run but no tops were released.

In Bienville Parish, Union Producing Co. and Pure Oil Co. 1 Nebo, 30-14n-5w, were delayed by dropping pipe in the hole. Total depth is 7,300 ft. in sidetracked hole. Operators had reamed to 4,020 ft., and in coming out drill-pipe stuck. Reports of a second operation by Union and Pure, 1 mile north of the Frazier test, or in 11-14n-6w, were unconfirmed this week.

Two miles northeast of Bear Creek field, in 19-17n-5w, C. H. Murphy 1 George Pipes, had total depth at 8,324 ft. in Travis Peak topped at 7,142 ft. Travis Peak sand was at 7,648-84 ft. Operators ran electric survey and prepared to drill out and perforate.

In Red River Parish, ½ mile west of a depleted gas well, K. M. Menefee et al 1 V. O. Barlow, 2-14n-12w, had total depth at 2,609 ft. on last report. Side-wall cores at 2,580 ft. showed gray, porous sand, with slight oil odor. From 2,581-85 ft., at 1-ft. intervals, there was gray sand, with no shows. Operators ran electric survey and shut down for orders.

Extensive seismograph work is indicated in Catahoula Parish, by The California Co.'s application to the Army for a permit authorizing temporary installations for underwater installations in Lake Catahoula, Old River, and the French, Cypress, Indian, Sandy, and Alligator bayous and their connecting waterways. The company seeks permission to install pipes, buoys, stakes, detectors, and such other equipment as will be necessary in the making of seismograph surveys of the underwater areas, it was said.

Operations are to be conducted within an area approximately 15 miles long and 13 miles wide, extending lengthwise north and south, and central to a point some 10 miles southwest from Rhinehart in LaSalle, Catahoula, Grant and Rapides parishes. Plans for the proposed work are on file in the office of Corps of Engineers in New Orleans. Protests, suggestions for modification or objections from the standpoint of navigation will be received to and including January 16.

In Union County, Arkansas, G. H. Vaughn 1 Annie Smith, 8-16s-17w, was reported to have shown both oil and gas on drill-stem tests around 6,350 ft., but the reports were not confirmed by operators. E. G. Bradham 1 C. A. Ward, wildcat test in 16-16s-14w, was running electric log at 4,000 ft.

NORTH LOUISIANA WILDCAT FAILURES

Tensas Parish: R. L. Fisher 1 G. H. Holloway, SE NE SW 10-10n-9e, dry, TD 5,010 ft., Sparta 1,740 ft., Cane River 2,725 ft., Talahatta 3,020 ft., Wilcox 3,185 ft.

Union Parish: T. L. James & Co. 1 Ida M. West, NE NE 7-22n-1w, dry, TD 2,723 ft.

Winn Parish: Burden-Kemp & Hunter 1 Tremont Lumber Co., SW NW 27-12n-2w, dry, TD 1,827 ft., Cane River 900 ft., Wilcox 1,117 ft., elev. 210 ft.

ARKANSAS WILDCAT FAILURES

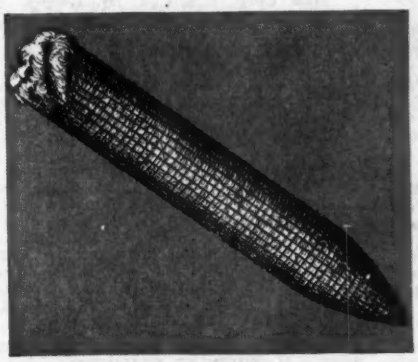
Columbia County: H. L. Hunt 1 D. H. Kitchens, NW NW 18-15s-21w, dry, TD 6,790 ft.

Hempstead County: J. A. Kennedy 1 A. C Coffee, SW SW NE 10-11s-24w, dry, TD 2,506 ft., Lower Cretaceous 94 ft., James 1,760 ft., Travis Peak 1,850 ft., Eagle Mills 2,400 ft., elev. 423 ft.

APPALACHIAN FIELD

Eleven New Locations Made in West Virginia

PITTSBURGH.—In Conemaugh Township, Indiana County, southwest Pennsylvania, T. W. Phillips Gas & Oil Co. completed a good second test on Westmoreland Mining Co. with a final gage of 1,632,000 cu. ft. of gas from a total depth of 1,526 ft.



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Only one new location was listed in the area during the week and it was in Washington district, Indiana County.

In Ripley district, Jackson County, West Virginia, the test of West Virginia Gas Corp., 548 Brady D. Hickel topped the Corniferous lime at 5,022 ft. from an elevation of 837 ft. In Ravenswood district, Columbian Carbon Co. topped the Corniferous lime at 5,022 ft. from an elevation of 837 ft. In Ravenswood district, Columbian Carbon Co. topped the Corniferous at 4,378 ft. in 984 Bianch Ashcroft from a surface elevation of 615 ft. The wildcat on Nathaniel Waterbury farm in Grant district is drilling at 2,171 ft.

In Cologne district, Mason County, the wildcat of Columbian Carbon Co., 993 Gildie Ankrum, topped the Injun sand at 1,648 ft. from a surface elevation of 671 ft.

New West Virginia locations totaled 11 and were in Elk district, Kanawha County; Harvey district, Mingo County; Grant and Union districts, Wayne County; Oceana district, Wyoming County.

In Grant district, Wayne County, E. C. Ware completed a good second test on United Fuel Gas Co. Mineral fee with a final gage of 1,476,000 cu. ft. gas, Maxton sand, total depth 1,350 ft.

WEST VIRGINIA SUCCESSFUL WILDCAT

Kanawha County, Elk district: United Fuel Gas Co. 5848 F. M. Staunton, 1,037,000 cu. ft. gas, elev. 972 ft., Corniferous lime 5,045 ft., Oriskany 5,163-5,207 ft., shot 5,159-5,236 ft., TD 5,244 ft.

WEST VIRGINIA WILDCAT FAILURES

Kanawha County, Elk district: United Fuel Gas Co. 6240 Mary F. Myers, dry, elev. 1,007 ft., Corniferous lime 5,323 ft., Oriskany 5,464-5,505 ft., TD 5,540 ft.

Pleasants County, Union district: DeLong & Barnhart 1 Addit McKinney, dry, Maxton sand TD 1,527 ft.

SOUTHWEST TEXAS

Deepest Production Opened For South Texas Frio Zone

CORPUS CHRISTI.—The deepest production in Nueces County and the deepest Frio zone production in South Texas has been opened by Tide Water Associated Oil Co. 1 Guaranty Title & Trust Co., wildcat test approximately ¾ miles southeast of the Saxet-Deep field production and 4 miles west of Corpus Christi. Drilled to a total depth of 11,490 ft., with 5-in. pipe set to 11,264 ft., perforations were made at 11,160-70 ft. and on latest test it flowed 155 bbl. of oil in 24 hours through a 10/64-in. choke. Drill-stem test in these perforations had flowed 45°-gravity pipe-line oil at the rate of 192 bbl. per day through ¼-in. and 10/64-in. choke, with 1,800 psi. working pressure and gas-oil ratio of 2,317.

Humble Oil & Refining Co. 2-B John G. Kenedy, Jr., wildcat ½ mile northeast of Sarita, in Kenedy County, tested wash water and slight show of gas on swab test through perforations at 10,711-22 ft. Total depth is 11,560 ft. with 5-in. liner set to bottom for production tests. Additional perforations have been made at 10,697-10,708 ft. to continue testing.

Southern Minerals Corp. 1 Mrs. C. H. Gerdes, in Section 53, Geo. H. Paul's Subdivision of Welder ranch, has extended gas-condensate production at Edroy pool, San Patricio County. Drilled to a total depth of 5,959 ft., on initial production gage flowed 23,000,000 cu. ft. gas per day on open flow, gas-condensate ratio 91,000; and through a ¼-in. choke flowed 3,328,000 cu. ft. gas per day, tubing pressure 2,255 psi., shut-in pressure 2,315 psi., no water. Production is through perforations at 5,940-48 ft. and 5,950-52 ft.

Hiawatha Oil & Gas Co. 1-A Denman, 1 mile southwest of Longhorn field, Duval County, recovered 10 ft. of condensate-cut mud, in a 9-minute drill-stem test at 4,848-52 ft. using ¼-in. chokes. On drill-stem test at 5,054-58 ft., using ¼-in. choke, developed 325 psi. working pressure and recovered 5 ft. of condensate in 6 minutes. Operators cored more gas sand at 5,058-67 ft. Now running a drill-stem test.

There were 28 new locations reported for District 4, 8 being wildcat starts, 3 in Duval, 2 in Cameron, and 1 each in Kenedy, Nueces and Webb counties. District 1 received 19 locations including 6 wildcats, 2 each in Guadalupe and Williamson, and 1 each in Edwards and La Salle counties. Two successful exploratory tests were completed to open new oil pay at Kennard pool in Starr County, and to extend gas-condensate production at Edroy pool, San Patricio County. Seventeen wildcats were dry, four in Webb, three in Duval, two each in Milam and Starr, and one each in Atascosa, Caldwell, Edwards, and Nueces counties.

SOUTHWEST TEXAS—DISTRICTS 1 AND 4—SUCCESSFUL WILDCATS

San Patricio County: Gas-condensate extension to Edroy pool—Southern Minerals Corp. 1 Mrs. C. H. Gerdes, in Sec. 53, Geo. H. Paul's Subd. of Welder Ranch, 3 mi. NW of Edroy, top pay 5,938 ft., TD 5,959 ft., perf., 5,940-48 ft. and 5,950-52 ft., IP: 23,000,000 cu. ft. gas per day on open flow, gas-condensate ratio 91,000; fl. 3,328,000 cu. ft. gas per day through ¼-in. choke, TP 2,255 psi., shut-in pressure 2,315 psi., no water.

Starr County: New oil pay Kennard pool—Coastal Refineries, Inc., and W. D. Kennard 4-E M. M. Garcia, dual completion, top pay 3,804 ft. (Paredes sand), perf. 3,804-16 ft., IP: 69 bbl. oil per day through ½-in. choke, top pay 4,018 ft. ("K" sand), perf. 4,028-32 ft. (New sand). IP: 82 bbl. oil per day through 7/64-in. choke, GOR 525, TP 1,050 psi., grav. 42.6°, TD 4,185 ft.

SOUTHWEST TEXAS—DISTRICTS 1 AND 4—WILDCAT FAILURES

Atascosa County: J. C. McCabe 1 Leonor Galindo, in F. de la Garza Sur., 9 mi. W of Poteet, dry, TD 2,951 ft.

Caldwell County: James H. Eddy and J. C. Foretich 1 John P. Williams Est., in Wm. J. Sneed Sur., 7 mi. NE of Luling, top Austin chalk 3,025 ft., no shows, dry, TD 4,000 ft.

Duval County: Continental Oil Co. 1 Virginia Garcia, in Santa Cruz de Concepcion (Francisco Cordente) gr., 2½ mi. E of gas prodn. at Sejita field, dry, TD 3,137 ft.

Ralph E. Fair, Inc., and Jack Woodward, Inc., 1 John O. Yages, in Rosa G. Gray Sur. 556, 20 mi. NW of San Diego, dry, TD 3,907 ft.

Pontiac Refg. Co. 1 G. N. Olson, El Mesquite Grant, 6 mi. NW of Hebbronville, dry, TD 2,995 ft.

Edwards County: Southwest Pet. Co. 1 Turney Ranch, 5 mi. from north line and 10 mi. from west line of county in CCS&RGNG Sur. 192, dry, TD 521 ft. in lime.

Hays County: B. C. Armstrong 1 B. Wraniitzky, in Albert Pace Hrs. Sur., 3½ mi. SE of Kyle, dry, TD 540 ft.

Milam County: P. C. Monagan and A. L. Clary 1 B. F. Darby, in M. Davilla 2-Lge. Grant, ½ mi. NW of Davilla, dry, TD 1,405 ft. in Edwards lime.

Milam County: Taylor Refg. Co. 1 H. Holdiness, in J. Nolan Sur., ½ mi. E of Milano, dry, TD 3,163 ft.

Nueces County: Seaboard Oil Co. of Del 16 John M. Luby, in M. J. Luby Subd. of Petronilla ranch, ¾ mile. S of Petronilla field, dry, TD 8,158 ft.

San Patricio County: Cam Corp. 1 F. M. McCarthy, Cubage & Miller Subd. of O'Connor ranch, 5 mi. N-NW of Odem, dry, TD 6,275 ft.

Starr County: H. L. Hunt 1 A. Alaniz, in Marcelino Alaniz Sur. 302, 6 mi. W of Sun field, dry, TD 5,519 ft.

O. C. Woods 1 Anna M. Kelsey, Sur. 125 3½ mi. NE of Arroyo Grande gas field, dry, TD 1,212 ft.

Webb County: Dulaney Oil Co. 4 J. G. Garcia, Los Ojelos Grant, 5½ mi. S of Oilton, dry, TD 1,858 ft.

Dulaney Oil Co. 5 J. G. Garcia, in Los Ojuelos Grant, 7 mi. S of Oilton, dry, TD 1,833 ft.

Gordon Johnson et al 1 Mabel Adami, Sur. 337, dry, TD 1,106 ft.

Harry E. Murray 1 Grant Adami, in Sur. 338, 1 mi. S-SW of Adami field, dry, TD 1,056 ft.

OKLAHOMA

Another Earlsboro Sand Hit in Centerpoint Pool

NORBLA OIL CO and Sunray Oil Corp. have deepened an old producer in Centerpoint pool to indicate a possible revival of the field. Operator's 1 Wagner, C SW SW 6-9n-3e, Pottawatomie County, has been deepened to 5,027 ft. in Earlsboro sand, casing run to bottom, and perforated from 5,002-18 ft. After cleaning out and swabbing, well flowed 20 bbl. an hour through tubing until tankage was full. The Wagner was originally completed in 1942 for 25 bbl. in upper Earlsboro at 4,930-4,965 ft.

Oklahoma Natural Gas Co. 3 Rider Unit, SE NE SE 16-5n-8w, Grady County, recovered 225 ft. of oil-cut mud on 90-minute drill-stem test indicating an oil well on northwest flank of Chickasha gas field. Test was in Noble-Olson sand which was topped at 3,045 ft. The 1 Rider on same lease was plugged back for small producer after having been taken to gas zone.

C. L. Hester and W. H. Potterf 1-A Ferguson, NE NW NW 8-7n-8e, Hughes County, north extension well to Holdenville pool, flowed an estimated 100 bbl. of oil daily while cleaning out after shot of Booch sand at 2,937-67 ft. Total depth is 2,980 ft.

Denver Producing & Refining Co., now in thirteenth month of drilling, is going ahead with its deep test, 1 School Land, 16-10n-9w, Caddo County. Last depth figure released was 14,581 ft. Seven-inch casing was cemented at 9,273 ft. Denver has 30,000 acres under lease in the vicinity.

Cotton County, with 11 new locations and 20 completions, highlighted the state's heavy activity for the week. State's totals were 78 locations and 103 completions. Other active counties were Stephens with 8 locations and 13 completions, Seminole with 8 and 6, and Carter with 7 and 7.

OKLAHOMA SUCCESSFUL WILDCATS

Cleveland County: Mid-Continent 1 Berry Estate, NW SW NW 32-9n-3w, flowed 422 bbl. of oil per day from Hunton at 8,784-8,830 ft., TD 9,850 ft.

Pontotoc County: Foran 1 Gipson, SE NW SE 30-4n-8e, produced 100,000 cu. ft. of gas from 488-506 ft., TD 842 ft.

Pottawatomie County: Clay 1 School Land, SE SE NW 36-6n-2e, produced 20 bbl. of oil per day from Trenton-Viola at 4,566-74 ft., TD 4,886 ft.

Stephens County: Riddell 1 Calmes, NW SW SE 35-1n-4w, produced 201 bbl. of oil per day from 5,163-88 ft., TD 5,188 ft.

OKLAHOMA WILDCAT FAILURES

Carter County: Chapman 1 Hooks, NE NW SW 12-1s-3w, dry, TD 3,219 ft.

Cleveland County: Zephyr 1 Banning, NE SE SE 36-9n-1e, dry, TD 6,240 ft.

Cotton County: Myers 1 Myers, NE NW NW 17-2s-10w, dry, TD 3,586 ft.

Rogers 1 Ramsey, NW NW NE 14-3s-11w, dry, TD 2,352 ft.

Kelleher 1 Phillips, NW NE SE 6-3s-10w, dry, TD 2,010 ft.

Garvin County: Peppers 1 Thompson, NW SE NW 18-4n-1w, dry, TD 5,938 ft.

Crofton 1 Odom, C SW SW 23-4n-2w, dry, TD 6,750 ft.

Sohio 1-A Kennedy, NW NW SE 26-1n-2w, dry, TD 9,987 ft.

British-American 1 Walter, NE NE NW 8-1n-1e, dry, TD 4,439 ft.

Greer County: Gilliland 1 Crow, NE SE SE 32-5n-21w, dry, TD 1,450 ft.

Hughes County: Viersen 1 Thompson, NW NW SW 34-7n-8e, dry, TD 3,494 ft.

Kay County: Abshire 1 Walker, SW NW SW 34-27n-2w, dry, TD 4,390 ft.
Lincoln County: Creekmore 1 Cooper, NE SW NW 30-14n-6e, dry, TD 5,064 ft.
Love County: Jennings 1 Eakin, SE SE NW 1-7s-4w, dry, TD 5,528 ft.
Carter 1 Carleton, C SE SE 39-6s-1e, dry, TD 9,012 ft.
McClain County: Universal 1 Moore, C NE NE 20-7n-4w, dry, TD 11,970 ft.
Murray County: Turner 1 Williams, NE NW SE 6-2s-4e, dry, TD 1,865 ft.
Okfuskee County: Herndon 1 Coleman, NW NW NE 34-12n-9e, dry, TD 4,137 ft.
Payne County: Mid-Continent 1 Correll Unit, SE NE NE 15-19n-1e, dry, TD 4,966 ft.
Morgan 1 Barker, SE SE SW 21-18n-1w, dry, TD 5,557 ft.
Stephens County: Lester 1 Beggs, NW SE NW 19-1n-6w, dry, TD 7,356 ft.
Lake 1 Marshall, SW SE NE 11-1s-6w, dry, TD 3,036 ft.
Little 1 Henderson, SW NW NE 29-2s-7w, dry, TD 3,605 ft.
Tillman County: Kingery 1 Johnson, SW SE SW 2-5s-15w, dry, TD 2,560 ft.

MISSISSIPPI

Massive Sand Test Due In New Oldenburg Well

JACKSON.—At Oldenburg, Franklin County, Danciger Oil & Refining Co. 1 Stark McKinney, 25-7n-2e, is preparing to set casing for production tests of Massive sand oil shows. Continuous coring was begun at 10,464 ft. but no shows were noted above 15,530 ft. at which depth a low-permeability sand was encountered which had a good odor but no perceptible stain to 10,535 ft. A 12-minute drill-stem test at 10,526-35 ft. had a fair blow of gas while unloading a portion of the water cushion but final recovery in the drill-stem was only 90 ft. of 43°-gravity oil with 40 ft. of slightly salty mud. Electrical log tops: Midway 7,760 ft., Selma 8,758 ft., Austin 9,218 ft., Tuscaloosa 9,711 ft., Marine Tuscaloosa 10,196 ft., Base Marine Tuscaloosa 10,424 ft., Massive sand 10,532 ft.

Testing operations have been delayed on the north extension well in La Grange field, Adams County. James E. Kemp 3 Marks, 8-6n-2w, is now waiting on plastic to set following an attempt to seal off a split in 5½-in. casing at a depth of 2,140 ft.

At Ovett, Jones County, Gulf Refining Co. 1 L. L. Majors, 29-6n-11w, has pumped for the past 7 days at an average rate of 184 bbl. of 31.3°-gravity oil per day with 2 per cent basic sediment and water.

In the Heidelberg Graben area Gulf Refining Co. 1 Mrs. R. Lyons Unit, 24-1n-12e, has recovered fish at total depth 11,492 ft., in Smackover limestone and is preparing to resume operations after hole has been conditioned.

Two wildcat starts were reported this week, one each in Madison and Rankin counties. The five development locations are two in La Grange field, Adams County, and three in Mallalieu field, Lincoln County. Three wildcat tests were completed dry, two in Holmes County and one in Sharkey County.

MISSISSIPPI WILDCAT FAILURES

Holmes County: Cities Service Oil Co. 1 R. A. Jordan Est., 34-14n-2e, dry, TD 6,103 ft. Electric log tops: Tuscaloosa 5,550 ft., Marine Tuscaloosa 5,835 ft., lower Tuscaloosa 5,920 ft., Massive sand 6,008 ft., Comanche 6,099 ft.
Noble Clay 1 Sam Hall, C NW SW 24-13n-3e, dry, TD 6,054 ft., ran electric log, no tops available.
Sharkey County: Maner Graham and R. H. Baker 1 D. B. Moore, NW NE NW 10-12n-6w, dry, TD 4,098 ft., ran electric log, no tops available.

FLORIDA WILDCAT FAILURE

Walton County: D. E. L. Byers 1 J. R. Sealey, NW NE 12-2s-18w, dry, TD 5,477 ft. Electric log tops: Eutaw 4,103 ft., Marine Tuscaloosa 4,672 ft., lower Tuscaloosa 4,927 ft., Massive sand 4,988 ft., Comanche 5,220 ft.

CANADIAN FIELDS

New Producer May Prove Extension to Leduc Field

CHATHAM.—In a potential northwesterly extension of Leduc field, Imperial-Woodbend 1, LSD 5, 15-51-26w4, is a definite producer at 5,285-95 ft. in the zone corresponding to D-3 of Leduc field. The well is 3½ miles northwest of the most northerly production in Leduc field. It has not yet been determined whether it is actually an extension or a new and separate producing area. Potential oil recovery has not been determined but the gas flow is definitely heavier than in the Leduc wells.

In an initial 40-minute test, gas flowed at a maximum rate of 3,225,000 cu. ft. daily, with 100 ft. of highly gassified mud and traces of condensate in the pipe. Coring and drill-stem tests were continued, and at 5,274-85 ft. in the upper part of the D-3 zone the flow was built up to 4,150,000 cu. ft. with evidences of light oil.

Imperial Oil, Ltd., seismographed the area before starting the wildcat test, and found a high similar to that which prompted the drilling of Leduc 1 discovery well, brought in last February. The completion brings several more sections into the area of possible production. Imperial holds a reservation from the Alberta government on all sides within Range 26, though there are individual holders of oil and gas rights in Range 25, commencing 3 miles east of the Woodbend discovery, which is 2 miles north of the Saskatchewan River. British American Oil Co. and Continental Oil Co. of Canada have jointly acquired holdings in this area and will drill.

Leduc.—In the Leduc field, official figures have been issued on three newly completed producers. Atlantic Oils 1, LSD 13, 23-50-26w4, finished at 5,337 ft., has 194 bbl. initial production. East Leduc-South Brazeau 1, LSD 8, 9-50-26w4, at 5,412 ft., has 195 bbl. Globe-Leduc West 3, LSD 10, 34-50-26w4, at 5,290 ft. had 179 bbl. All are on 12/64-in. choke.

Atlantic Oils 2, LSD 14, 23-50-26w4, 23-50-26w4, drilled out to 5,356 ft. with flush of 110 bbl. an hour, or 2,640 bbl. daily, pressure during the run being built up to 200 lb. on casing and 345 lb. on tubing. Production comes from the D-3 zone. Atlantic 3, LSD 12, 23-50-26w4, immediately south of No. 1 producer, is drilling.

Central-Pyrcz 2, LSD 13, 25-50-26w4, is swabbing after drilling out to 5,295 ft. Imperial 23, LSD 1, 21-50-26w4, after blowing in, died down, and was deepened to 5,125 ft. for further tests. Imperial 25, LSD 4, 27-50-26w4, also blew in at 5,031 ft., faded out and is being swabbed back into production. Imperial has four other wells drilling, three in lime, one rigging, and has five new locations.

Globe-Leduc West 4, LSD 15, 34-50-26w4, coring at 5,283-93 ft. developed a 251,000-cu. ft. gas flow, with oil coming to the top 50 minutes after tester was opened.

Legal.—In eastern Alberta, north and east of Leduc field, Imperial-Legal 1, LSD 3, 18-58-24w4, has been abandoned at 6,500 ft. Imperial-Legal 2, LSD 1, 17-58-24w4, farther to the east, was spudded, as a further test of the Devonian limestone possibilities at this point.

Turner Valley.—An important new exploratory development is being undertaken in North Turner Valley, where Home Oil Co. is starting three new wells, a mile west of the substantial producers recently completed in this area. Home-Millarville 27, LSD 16, 18-21-3w5, with Madison at

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8,526-896 ft., made 37 to 38 bbl. an hour on a 6-hour test. Home-Mallarville 28, LSD 10, 18-21-3w5, with Madison at 8,455-8,899 ft., gave 761 bbl. on a 24-hour run. Upo porous has not been acidized in either well. Home-Millarville 30, LSD 7, 33-20-3w5, got limestone contact at 7,930 ft. and is being deepened into production.

Stettler.—Joint development of 18,000 acres in the Stettler area of Alberta, midway between Steveville and Leduc fields, is being undertaken by Canadian Gulf Oil Co. and Piccadilly Porcupine Gold Mines. Gulf-Piccadilly 1 has location in LSD 14, 16-39-21w4, to spud immediately.

Bantry Lake.—In the Bantry Lake area, southern Alberta, California Standard-Imperial 1, LSD 1, 2-18-13w4, looks like the discovery well for a considerable area, with production from the basal Cretaceous. Placed in production, it has flowed by heads, making 7 bbl. an hour for several hours restricted to 15/64-in. choke, and is still testing for the most favorable production basis. No. 2 has location in LSD 1, 2-18-13w4, a mile north of discovery.

Pincher Creek.—In the Pincher Creek area, close to the Montana boundary, Canadian Gulf 1, LSD 15, 24-3-29w4, after striking a heavy wet gas flow at 11,745-11,800 ft., is coring below 11,829 ft. and is waiting for high pressure equipment to make a further production test.

Lloydminster.—In the Lloydminster field, official figures have been issued on three new producers. Win-Lloyd 2, LSD 6, 16-50-1w4, at 1,932 ft. has 65 bbl. a day flush. Win-Lloyd 5, SE 10, 10-50-2w4, finished at 2,040 ft., has 70 bbl. Win-Lloyd 6, LSD 15, 10-50-2w4, at 2,017 ft. has 35 bbl. Command-Lloyd 4, LSD 10, 16-50-1w4, finished at 1,946 ft., had 800 ft. rise of oil after perforating. Command-Lloyd 2, same LSD finished at 1,944 ft., had flush of 200 bbl. but is being choked down. South of the field, Dinalta 1, LSD 10, 25-44-1w4, finished at 1,825 ft., showed oil rise of 900 ft.

ROCKY MOUNTAIN

New Wyoming Pay Seen; Utah Wildcat Testing

DENVER.—Discovery of a new pay in Wyoming appears eminent with the coring of saturation by Phillips Petroleum Co. and Kerr-McGee Oil Industries at Sheldon Dome, Fremont County. The well is 1 Arapahoe, C NW NW 15-5n-2w (WRM), an extension one location east of the discovery well on the structure. Top of the Tensleep was logged at 6,817 ft. and the operator is now drilling below 6,950 ft. in sand, showing streaked saturation. On drill-stem test 6,884-6,932 ft. the well made 120 ft. of black oil in 1 hour, and on test 6,817-46 ft. the recovery was 105 ft. of black oil in 1½ hours. This well is higher structurally than the discovery well, and faulting between the two tests is indicated. The discovery well was drilled by Carter Oil Co. and Phillips in 1945, and reworked in 1946 for a discovery in the Embar, producing an initial of 148 bbl. of oil with some water in 24 hours. No saturation was found in the Tensleep in the discovery well, and the present test failed to find production in the Embar. The operator will core and drill through the Tensleep for more thorough tests of this formation.

Mush Creek activity.—Further important extensions are now being completed in the Mush Creek area, Weston County, Wyoming, where active drilling during the past year has added considerably to the State's current production. Morton Oil Co.'s extension test at 2 Michaels, NW NE NE 26-44n-63w, is now reported flowing 50 bbl. of oil hourly from Newcastle between 3,867-90 ft. This well is an east offset to the same company's 1 Michaels, which a week ago was completed flowing 100 bbl. of oil daily from the Newcastle sand. The latter well extended the productive area of the field 2 miles south, and indicates existence of a new pool in the area. In the north pool of the field Walt Bradley et al have completed 2 Bradley, SE SW SW 8-44n-63w, flowing 320 bbl. of oil daily. This well is an extension on the north side of the field and found Newcastle 4,213-38 ft. Approximately 2,000 bbl. of oil daily from this field is being marketed at Newcastle, Wyoming, refineries.

Utah wildcat now testing.—During the past 2 years a large amount of exploratory work, leasing and drilling has been done in Utah, although this state has no oil production at the present time. One of the most important tests to be drilled in the state in recent years is The California Co.'s Upper Valley wildcat, located in the south-central section of the state. The well is 1 Unit, C SW NW 12-36s-1e, Garfield County, and location followed extensive geological and geophysical work in the area. The well was drilled to 6,302 ft., total depth, with Kaibab topped at 6,041 ft. Casing has been run to the top of the Kaibab, and the operator is now reported testing with the well plugged back to 6,200 ft. Shows of oil have been rumored in the well, although the operator has not confirmed this fact. It is also rumored the well is in Coconino at the present depth, but top of this formation has not been released by the operator. Coconino was the announced objective of the well, but it is now reported that the well will be drilled through this formation to depths between 10,000 and 11,000 ft. This is the deepest test to be drilled in this section of the state.

Casing has also been run at another interesting wildcat in southern Utah. The well is Western Natural Gas Co., Byrd-Frost, Inc., and P. B. English's Boulder Knoll test at 1 Redd, C SE NE 23-34s-25e, San Juan County, near the Colorado state line. Total depth of the well is 7,968 ft. and 7-in. casing has been set near the bottom of the hole. At this depth the well is in the base of the Paradox formation, where shows of oil have been encountered in other tests drilled in the Salt Basin of Utah and Colorado. The operators plan to drill through the Paradox for a test of lower formations.

Dry Creek field, Montana, extended.—Ohio Oil Co. 1 D. J. Parker, SE SE NW 4-7s-21e, Carbon County, Montana, will apparently extend the Dry Creek field 1 mile northwest of present production. The well topped the Dakota at 6,030 ft. and on drill-stem test 6,030-50 ft., 200 ft. of oil with 20 ft. of mud was recovered on 30-minute test. This field was discovered in 1930 and has produced more than two and a half million barrels of oil from seven wells since that time. There has been no recent drilling in the field, although this extension, on the northwest side of the field, will probably lead to further development in the area.

New operations.—Eighteen new operations were reported, of which nine were in Wyoming, six in Colorado, and three in Montana. One of the Colorado locations was of importance as a deep wildcat in a new area. This was Stanolind Oil & Gas Co. 1 Colorado Fuel & Iron, SW NE SW 31-34s-63w, in the Morley Dome area, Las Animas County. The well is scheduled as a 7,500-ft. test. Other Colorado locations were in the Rangely field and at Red Mesa, La Plata County, in the San Juan Basin. In Wyoming, Superior Oil Co. is preparing to spud at the fifth Tensleep well at Herrick Dome, which was a 1947 discovery, and other locations were for pool wells. The Texas Co. is rigging up for a south offset to the recently completed Ragged Point, Montana, discovery. The wells is 1 Cotter, NE NW NE 8-11n-3e, Musselshell County, and will be drilled to the Kibbey (Big Snowy Group) sand.

Completions.—There were 25 completions during the week, of which 13 were in Wyoming, 8 in Montana, and 4 in Colorado. Total initial oil production for all completions was 3,851 bbl. from 20 wells, with the balance dry holes. Included in the completions was Sinclair Wyoming Oil Co.'s Madison discovery at Lost Soldier, Sweetwater County, Wyoming, which made an initial after acidizing of 1,045 bbl. through open tubing. Other wells in Wyoming were pool completions, with the exception of the Morton Oil Co. south extension at Mush Creek in 1 Michaels, which was finally completed flowing 100 bbl. of oil daily after initial tests had indicated a much better producer. Texas' Ragged Point, Musselshell County, Montana, discovery was given an official completion of 228 bbl. of oil daily, following shooting. Other wells in Montana and Colorado were pool completions.

MONTANA SUCCESSFUL WILDCAT

Ragged Point, Musselshell County: Texas' Manion 1, SE SW SE 5-11n-30e, TD 6,312, PB 4,457, Kootenai 2,050, Ellis 2,420, Red Beds 2,800, Big Snowy 2,970, Heath 3,355, Otter 4,000, Kibbey 4,380, Charles 4,625, Madison 5,198, Cambrian 6,276.

WYOMING SUCCESSFUL WILDCAT

Lost Soldier, Sweetwater County: Sinclair Wyoming 77 Unit "A," SE NE NE 10-26n-90w, TD 5,039, PB 5,031, Tensleep 3,989, Amsden 4,545, Madison 4,728, elev. 6,897 DF, 5½-in. csg. 5,035, OWDD OTD 4,285, flowed 1,046 bbl. oil 24 hours after 6,600 gal. acid, perf. 568 holes 4,950-5,030.

WYOMING WILDCAT FAILURE

Little Laramie, Albany County: Superior and California 1 Bath, NW NW SW 4-16n-75w, 2,961 TD, Casper 3,770, Herrick pay 3,901, water, OWDD OTD 3,886, dry.

OHIO, KENTUCKY

New Gas Pool Indicated For Lorain County, Ohio

COLUMBUS.—The Medina sand wildcat drilled in by Fred Beasley et al on Luther Tippie, Section 3, Malta Township, Morgan County, was not shot but put to pumping, and is making about 25 bbl. per day. The oil has been classified as Pennsylvania Grade. Three additional locations have been reported in the immediate vicinity and one other, 3½ miles to the southeast, in Penn Township:

Indications of a new gas pool in the south part of the Penfield Township, Lorain County, was found by the Ohio Fuel Co. on Hilda Gustatson, Lot 25, Section 1. Clinton sand at 2,458-67 ft. came in with a natural open flow of 1,330,000 cu. ft. An offset well will be started soon.

Shuff & Bucy's 2 Ora Johnson, Section 14, Jackson Township, Knox County, missed the Newburg but found a good showing of oil in the Clinton sand, 2,976-3,031 ft. After a shot the well made 100 bbl. in 24 hours.

The Sayre pool was extended ½ mile to the south by a small well on the Sunday Creek Coal Co., Section 4, Pleasant Township, Perry County. The completion, by Ohio Fuel, showed 250,000 cu. ft. natural in the Clinton sand 3,613-70 ft., and 475,000 cu. ft. after shot. The well was drilled through the Medina horizon without finding any sand.

Of the 23 new locations for the week, Stark County reported 6, Perry, Ashland, and Meigs counties 3 each, and Muskingum 2. Ashland and Brush Creek fields led in completions with 6 each out of a total of 22.

OHIO SUCCESSFUL WILDCAT

Morgan County, Malta Township: Fred Beasley et al 1 Luther Tippie, Section 3, Medina 4,654-4,659 ft., still in sand, 25 bbl., TD 4,659 ft.

OHIO WILDCAT FAILURE

Carroll County, Brown Township: Union Drilling Co. 1 Whitacre Fire Proofing Co., Sec. 24, Clinton 5,200-63 ft., TD 5,352 ft.

WESTERN KENTUCKY

OWENSBORO.—R. H. Compton and Ashland Oil & Refining Co. 1 Susie Kirtley, 19-L-28, possible pool-opener 1½ miles north of Island pool, McClean County, is cleaning out after 40 qt. shot in Benoist sand at 1,778-93 ft. One-hour drill-stem test recovered 150 ft. of clean oil and 50 ft. of oil-cut mud.

Ashland Oil & Refining Co.-Basin-Yunker 1 Crafton, 9-O-24, wildcat near Anthoston pool, is pump testing Tar Springs at 1,672-90 ft. Total depth is 1,708 ft.

INDIANA

EVANSVILLE.—C. M. Amsler 2 Mary Witherspoon, SW SW NW 26-2s-10w, Gibson County, wildcat 1 mile southwest of West Francis pool, has set casing to test O'Hara at 1,927-35 ft.

Two wildcats are in initial stages in Vanderburgh County. Indiana Farm Bureau and Ray Carlson 1 H. F. Wilhelmus, NW NW SW 6-6s-10w, has set surface pipe. Pond & Slocum 1 Alvin Kercher, SW SE NW 4-6s-11w, has been staked as location.

KANSAS

Ben Brack May Extend Ryan Pool to North

BEN F. BRACK, INC., 1 Rankin A, SE SW SE 27-19-16, ¼ mile north of Ryan pool, southeastern Rush County, has taken three favorable drill-stem tests of Arbuckle lime. First test from 3,692-3,720 ft. flowed an estimated 1,000 M.c.f. of gas in 20 minutes, and recovered 65 ft. of gas-cut mud. Next, a 25-minute test at 3,720-50 ft. had gas in one minute and flowed an estimated 2,300 M.c.f. Recovery was 240 ft. of oil and mud. Third test at 3,743-50 ft. recovered 150 ft. of oil after tool was open 20 minutes.

Wood River Oil & Refining Co. 1 Ney, SW SW NE 31-15-12, wildcat 1 mile east of Trapp pool, southern Russell County, has set casing to test shows of oil in Arbuckle. Arbuckle was logged at 3,357 ft. and 7-in. casing was set 1 ft. into formation.

Cities Service Oil Co. 1 Hall M, SE SE SE 11-12-17, wildcat 2 miles south of Bemis pool, Ellis County, has set 5-in. casing at 3,592 ft. to test shows of oil in Lansing-Kansas City. Lansing was topped at 3,341, conglomerate at 3,600 ft., erosional Arbuckle at 3,643 ft., and Arbuckle at 3,656 ft. Total depth is 3,690 ft.

Robert L. Williams 1 Soeken, SE SE SW 30-20-11, ½ mile north and ½ mile west of Kowalsky pool, southeastern Barton County, is showing as a good well having swabbed 13 bbl. of oil per hour for 3 hours from 2,160 ft. off bottom. Well topped Arbuckle at 3,381 ft. and was drilled to total depth of 3,394 ft.

Sheedy and associates are rigging up their Taylor No. 1, a test of a Mississippi lime high in 13-25s-14e, Woodson County. Leasing activities have begun on the strength of this well, and if this opens up another pool in Woodson County, it will cause considerable activity, due to the economical operations in this vicinity.

Barton and Butler counties led the state in activity for the week as they did the previous week. Barton had 5 new locations and 8 completions while Butler registered 5 and 7. Other leaders were Rice with 7 and 4, Russell 5 and 2, Rooks 2 and 7, and Ellis 6 and 4.

KANSAS WILDCAT FAILURES

Barton County: Slageter et al 1 Ruttledge, SW NW SW 33-17s-11w, dry, TD 3,343 ft.
Butler County: Hager 1 Webb, NE SW SW 13-26s-6e, dry, TD 2,745 ft.
Shawver & Graham et al 1 Nelson, SW SW SW 33-28s-3e, dry, TD 3,265 ft.
Cowley County: Sohio Oil and H. M.. Willaims 1 Near, NE SE SW 22-31s-3e, dry, TD 3,426 ft.
Marion County: H. J. Uhl et al 1 Duerkson,

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SE SE SW 14-20s-1e, dry, TD 3,216 ft.
McPherson County: Wood River Oil Co. 1 Tischauser, SW SW SW 11-17s-1w, dry, TD 2,830 ft.
Rooks County: Harry Gore and Bennett & Roberts Drilling Co. 1 Radke, SW SW SW 23-8s-18w, dry, TD 3,490 ft.
Stafford County: Virginia Drilling Co. et al 1 Durham, NW SW NE 33-22s-13w, dry, TD 3,912 ft.
Huber-Cook & Galloway et al 1 Miller, NW NW NW 6-23s-13w, dry, TD 3,935 ft.
Sumner County: Bridgeport Oil Co. 1 Kelley "A," C E/2 SE SE 19-30s-4w, dry, TD 3,638 ft.

PERMIAN BASIN

Discovery Well Finished, Rig Moving to Offset

MIDLAND.—Sun Oil Co.'s third Coke County discovery, the 1 J. W. Arledge, was shut in this week and the rig moved to an offset location, after flowing 94 bbl. of oil, naturally, in 23½ hours. The flow was through ¼-in. tubing choke, from open hole in the Marble Falls limestone of the Pennsylvanian, between 6,602-20 ft. Flowing pressure on the tubing ranged from 470 psi. down to 150 psi., and casing from 1,200 psi. to 925 psi. There was no water. Location is in the NE SW Section 261, Block 1-A, H&TC Survey, 4½ miles northwest of Sanco. After the rig was moved, the well was tested through various size chokes, recovering 127.7 bbl. of 43°-gravity oil in a total of 20 hours and 40 minutes, with no water.

Offset northeast location is for the 2 Arledge, 1,890 ft. from north and east lines of Section 261, Block 1-A, H&TC Survey. It is scheduled to 6,650 ft.

Humble Oil & Refining Co.'s Hale County discovery, the 1 J. A. Lutrick, Section 14, Block D-8, EL&R Survey, was shut in after swabbing 40 bbl. of oil an hour for 6 hours to fill all available storage. The well topped Pennsylvanian limestone at 7,923 ft., and drilled to 7,987 ft. Acid treatment was between 7,908-87 ft. Before being swabbed, the well made a flow of 150 bbl. of fluid, mostly oil, then died. Location is about 7 miles northeast of Abernathy, and 4½ miles southwest of the one-well Petersburg field, which produces from the Cisco limestone, of the Pennsylvanian.

In northwestern Andrews County, McAlester Fuel Co. moved in heavy rotary tools to deepen the 1 M. M. Fisher from 7,350 ft. to around 11,500 ft., unless oil is found earlier. Companies said to be supporting the test include Sinclair-Prairie Oil Co., Union Oil Co. of California, Amerada Petroleum Corp., and Fred Turner, Jr., of Midland; all holding adjacent acreage. Location is 11 miles northwest of Andrews and 1 mile north and ¼ mile west of nearest production in Shafter Lake field. Old total depth of 7,350 ft. was in the lower Permian limestone.

Gulf Oil Corp. last week filed application to complete 1 H. B. Cox, a core hole in Section 6, S. Sloan Survey, as a shallow producer. The well showed oil from 894-911 ft., and was drilled to 1,251 ft. before being plugged back to 943 ft. for completion tests. On a 14-hour pumping test, it made 37 bbl. of 26.4°-gravity oil. Pay zone is a Permian sand. Location is 29 miles west of Ozona; about 4 miles west of another of Gulf's core tests which had oil in the Grayburg around 1,685 ft., and about the same distance south of the Clara Couch field.

The new Shafter Lake Devonian area of Andrews County received its third producer when Sinclair-Prairie Oil Co. 1-155 University flowed oil on a drill-stem test of the Wolfcamp from 8,395-8,415 ft. Using a 900-ft. water blanket, and open 2½ hours, gas came to the surface in 30 minutes, drilling fluid in 1 hour and 40 minutes, and oil at the end of 2 hours. It flowed 23½ bbl. of oil to storage, with no water, in 30 minutes. Operators then continued drilling below 8,455 ft. The 1-55 University is a northwest offset to the Devonian discovery. Gulf Oil Corp. 1-QQ University, east offset location to the discovery, was drilling at 8,902 ft.

In southern Reagan County, Moore Exploration Co. 1-A University was cleaning out after shooting from 2,405-69 ft., where drilling samples showed some oil stains. Location is 2,310 ft. from the north and 2,469 ft. from east lines of Section 13, Block 12-U. Hunt Oil Co. 1-B University, 330 ft. from north and 350 ft. from east lines of the SW of Section 14, Block 12-U, was preparing to acidize, at total depth of 2,481 ft. Reports indicated it carried some 100 ft. of oil in the hole while drilling and filled at the rate of 1 bbl. an hour. An Ellenburger test for the area, by Hunt & Moore, is said to be scheduled as the 1-E-A University, NE NE Section 14, Block 12-U.

WEST TEXAS (DISTRICTS 7-C AND 8) SUCCESSFUL WILDCATS

Coke County: Sun Oil Co. 1 J. B. Walker, 660 ft. from SE line, 660 ft. from SW line, C. Brockhuysen Sur. 526, 4 mi. SW Jameson field, flowed 444 bbl oil per day, ¼-in. choke, lime pay 6,114-6,260 ft., TD, GOR 1,260 cu. ft., 48°-gravity, casing pressure 1,500 psi., tubing pressure 1,000 psi., elev. 2,029 ft.
Glasscock County: R. U. Fitting, Jr. 1 W. R. Settles, Sec. 158, Blk. 29, W&NW Sur., ¾ mi. S Howard-Glasscock field, sand pay 1,408-30 ft., 32°-gravity.

WEST TEXAS (DISTRICTS 7-C AND 8) WILDCAT FAILURES

Andrews County: Cascade Petroleum Co. 1-A University, Sec. 33, Blk. 1, University Lands, dry, TD 4,874 ft., anhydrite 1,840 ft., Grayburg 4,530 ft., elev. 3,078 ft.
Crane County: The Texas Co. 1 Richard King, Sec. 83, Blk. X, GC&SF Sur., 10 mi. S Crane, dry, TD 7,293 ft., San Andres 2,350 ft., Glorietta 3,110 ft., Devonian 5,464 ft., Silurian 5,740 ft., Simpson 5,975 ft., Ellenburger 7,120 ft., elev. 2,446 ft.
Crockett County: Stanolind Oil & Gas Co. 1-E David Fasken, Sec. 45, Blk. 42, GMMB&A Sur., E of N. Cowden field, dry, TD 7,503 ft., Grayburg 4,540 ft., Clear Fork 6,443 ft.
Floyd County: Standard Oil Co. of Texas 1 L. M. Daniel, A. B. Duncan Sur., 7½ mi. S Floydada, dry, TD 7,001 ft., Glorietta 3,215 ft., Clear Fork 3,385 ft., Cisco 6,440 ft., elev. 3,041 ft.
Howard County: Russell Maguire 1 J. W. Fryar, Sec. 4, Blk. 33, T&P Sur., 7½ mi. NW Big Spring, dry, TD 3,213 ft. in lime.
Lamb County: Forrest, Jergins and H. R. Smith 1 Ida Mary Harris, Labor 15, Lge. 661, State Capitol Lands, 2 mi. SW Amherst, dry, TD 7,242 ft., San Andres 3,090 ft., Glorietta 4,440 ft., Clear Fork 4,970 ft., Wolfcamp 6,180 ft., elev. 3,655 ft.
Runnels County: Lion Oil Co. 1 Harris Davenport, Subd. 23, J. J. Ximenez Sur., 6 mi. E Winters, dry, TD 4,565 ft., Palo Pinto 3,334 ft., Ellenburger 4,441 ft.
Sutton County: Olson Drilling Co. et al 1 W. A. Miers, Sec. 63, Blk. 14, TW&NG Sur., 16 mi. SW Sonora, dry, TD 6,215 ft., Strawn 4,870 ft., elev. 2,305 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—A new and deeper pay, in the Permian, for the Monument field of Lea County, was reported at Amerada Petroleum Corp. 5 Phillips, NE NE 1-20s-36e. The well flowed 840 bbl. of 42.5-gravity oil a day from perforations between 5,180-5,200 ft., flowing through ¼-in. choke, with gas-oil ratio of 490 cu. ft. Regular pay for the field is around 3,900 ft. Total depth of the 5 Phillips was 9,953 ft., but geological information on the lower depths was not released. Amerada's 2 Record, deep operation in the same field, was fishing for core bit. Total depth is 11,310 ft.

In Eddy County, 27 miles west of Carlsbad, Magnolia Petroleum Co. 1-W State, 16-21s-22e, was drilling ahead below 3,000 ft. toward its 7,500-ft. goal, after stopping to drill-stem test a show of oil in dolomite between 2,035-87 ft. The test was open 1 hour, during which time it blew for 10 minutes, and recovered 10 ft. of mud with no shows.

Southern Union Producing Co. 1 Elliott, 24-18s-23s, was drilling ahead below 6,728 ft. It is scheduled to the pre-Cambrian, expected around 7,500 ft.

SOUTHEAST NEW MEXICO WILDCAT FAILURE

Eddy County: R. W. Fair 1-B Bowers, NW NE 29-19s-17e, dry, TD 2,505 ft. in lime, red sand 844 ft.

ILLINOIS

Gulf Refining Wildcat Flows 541 Bbl. in 13 Hours

MATTOON.—Gulf Refining Co. B-1 Parks, NE NE SE 34-6s-5e, Hamilton County, 1 mile south of Rural Hill pool, flowed 541 bbl. of oil in 13 hours on test of O'Hara at 3,364-85 ft. Total depth is 3,549 ft.

George & Wrather and C. Chandler 1 M. Monroe, NE NW NE 27-2s-6e, Wayne County, test 3 miles south of Sims and 2 miles northwest of Mayberry pool, has set casing to test McClosky at 3,331-43 ft. and 3,401-07 ft. One-hour drill-stem test of zone at 3,331-43 ft. recovered 2,400 ft. of oil, 30 ft. of mud, and 30 ft. of salt water.

Phillips Petroleum Co. 2 Townsend, S½ NE SE 35-2n-14w, Wabash County, wildcat 3 miles northwest of West Lancaster pool, flowed 396 bbl. of oil in 17 hours from O'Hara pay at 2,897-2,900 ft.

ILLINOIS SUCCESSFUL WILDCATS

Effingham County: Central Pipe Line Co. 1 Mettes, SE SE SW 33-8n-7e, IPP 57 bbl., 40 perforations 2,659-68 ft., TD 2,808 ft.
Wayne County: Robinson & Puckett 1 Smith, SE NE SW 36-1n-5e, IP 25 bbl., 3,000 gal. acid, McClosky pay 3,105-12 ft., TD 3,117 ft.

ILLINOIS WILDCAT FAILURES

Bond County: Hirst 1 Guthrie, S½ SE SE 34-4n-2w, dry, TD 2,720 ft.
Coles County: British-American 1 Anderson, SW NW SW 36-12n-9e, dry, TD 1,523 ft.
British-American 1 Worth, SW SW NE 36-12n-9e, dry, TD 1,624 ft.
Hamilton County: Nat'l. Assoc. 1 Frey, NE NE SE 30-3s-6e, dry, TD 3,440 ft.
Jefferson County: Robinson & Puckett 1 Marsh, SE NE NW 1-4s-4e, dry, TD 3,329 ft.
Aurora Gas 1 Novak, SE SE SW 5-3s-1e, dry, TD 2,372 ft.
Richland County: George & Wrather 1 Brinkley, SW NE SE 12-4n-10e, dry, TD 3,104 ft.

A.P.I. Sets Spring Meeting

WASHINGTON.—In line with its policy of spreading its meetings over the various sections of the country, the American Petroleum Institute has scheduled its spring meeting for May 6-7 at Haddon Hall, Atlantic City.

Details of the meeting have not been worked out, and probably will not be announced until March, but it is planned to have a business session and a program covering the most important oil issues of the moment.

A general invitation will be extended to all marketers and the officials of marketing trade associations who may be interested in the subjects to be discussed.

Auto Designers Advised Not to Specify High-Octane Fuel Now

by Arch L. Foster

DETROIT.—Utilize the qualities of present-day motor fuels to the fullest extent before you demand improved qualities and performance, W. M. Holaday, Socony-Vacuum Oil Co., told the Society of Automotive Engineers here January 22.

Beginning with the end of World War II, Holaday showed what has happened since we started making postwar fuels with our present facilities. Holaday believes that the octane number level of motor gasoline will not increase at as fast a rate as it has in the past because of the fact that more than $4,000,000,000 must be spent over the next few years to increase production and refining capacity to meet quantity demands alone.

Automotive design and fuel-marketing capacities can bring about a readjustment in the range between the octane rating of regular and premium-quality gasolines to give, with present refining equipment, about 20 per cent premium gasoline sufficiently high in antiknock quality to meet the requirements of proposed high-efficiency passenger-car engines.

Rather than depend solely on octane number increases for improved economy, automotive engineers should study the manner in which present-day engines are utilizing the antiknock properties which refiners are building into motor fuels now being supplied, Holaday said. Any design which leads to a fuller utilization of antiknock quality than is accomplished by current engines will show improved economy. Pointing out that the higher antiknock of modern fuels is needed only a very small part of the total operating time, Holaday recommended that cars be provided with a dual carburetor system; one carburetor would supply premium-grade fuel at those times when it is needed for knock-free operation, while the other, supplying regular-grade gasoline, would feed the engine through the greater part of its operation.

With our present refining facilities, about 20 per cent of premium fuel can be made, a fuel in which 2 ml. of TEL shows 97 Research octane number; the remaining 80 per cent of our consumption can be 83 Research octane number, satisfactory fuel for the great majorty of cars, old and new, now on the road. Our present consumption of premium fuel ranges closer to 50 per cent in various parts of the country.

Reason for Action

The all-important reason why the automotive industry should utilize to the fullest the qualities in our current motor fuels is that of economy of natural resources, and to aid in meeting the unprecedented demand for these fuels, Holaday said. Refiners have the facilities for making more octane numbers if and when needed, he said; however, these increases in antiknock quality can be obtained only at the expense of yields, and at a time when the maximum yields of all products are imperative. Therefore the automotive engineers must design to gain economy and performance from present fuel standards rather than demand higher octane number; antiknock quality in great measure now goes begging because engines are not designed to utilize the existing quality. Marketing of a super-premium fuel, considerably higher in antiknock than our present premium grade, is simply not feasible, Holaday said.

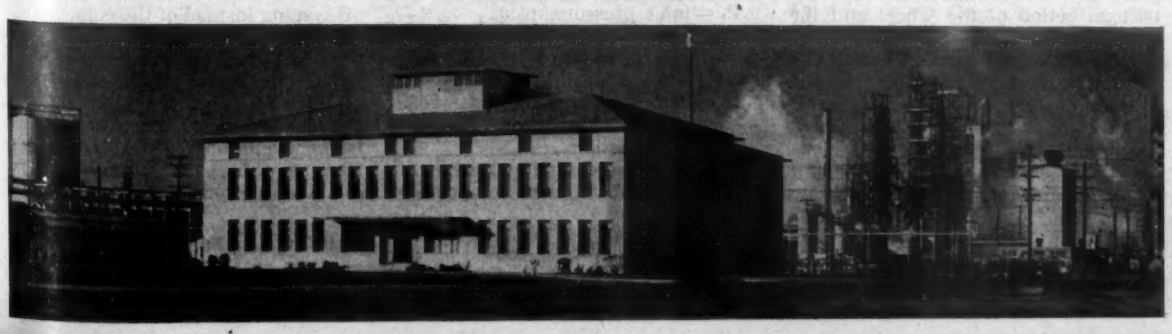
The cost of a simple distillation type of refinery for processing 100,000 bbl. of crude per day is now about $16,000,000 to make 68-70 octane-number gasoline, Holaday showed Add thermal cracking and the figure jumps to $24,000,000, a 50-per cent cost increase, to make "cheap octane numbers." With thermal reforming to make 77-82 octane-number fuel only $2,000,000 more is required to build the whole plant. Catalytic polymerization to utilize the light olefins formed boosts the cost another $1,500,000 but the big hop comes when adding catalytic cracking, when the plant cost reaches $65,000,000. If hydroforming is installed also, the finished refinery will be on the books at $90,000,000. Hydroforming loses 20 per cent of the straight-run gasoline, thus reducing the yield and gaining only octane numbers and sulfur freedom.

Raising the average antiknock rating by one octane number during war years cost the industry $300,000,000 in investment, it was said. The automotive industry was urged to use the dual fuel system already mentioned, to install the hydraulic type of coupling (fluid transmission), inject water to improve antiknock qualities, and use rich mixtures under high-load conditions such as is done in aircraft engine operations.

Analysis of diesel fuels shows that straight-run fuel contains about 80 per cent of paraffin hydrocarbons, while catalytically cracked fuels contain about 61 per cent of paraffins, H. M. Smith of the U. S. Bureau of Mines reported. Cooperating with the Western Petroleum Refiners Association, it was found that the straight-run fuel generally has a wider boiling range than the cracked materials studied; the cracked fuel shows 35 per cent of aromatics, compared with 18 per cent for the straightrun.

All 13 isomeric hexenes have been synthesized in high purity at Ohio State University, Dr. Cecil E. Boord, head of this extensive research (A.P.I. Research Project 45), said since the work was started in 1938. At the end of 4 years, 84 hydrocarbons had been synthesized and engine-tested, along with 10 others supplied by the National Advisory Committee for Aeronautics and 3 from other sources. All of the 27 heptenes and 54 of the 66 possible octenes have been made also; in all, 180 hydrocarbons have been synthesized and studied for physical properties and antiknock quality.

This new $850,000 building houses administrative offices and research facilities at the Esso Laboratories, Baton Rouge, La. The new building, dedicated last week, is located within the Baton Rouge refinery of Standard Oil Co. of New Jersey, Louisiana division. Though also engaged in exploratory research and small-scale development in refinery techniques, the Esso Laboratories, established 21 years ago, serves as the main pilot-plant center of the Jersey Standard organization. The new building is, the first of several units planned. Building design and laboratory equipment provide the most modern facilities for advanced research projects. Director of the Esso Laboratories is A. Voorhies, Jr.



First High-Pressure Centrifugal Compressor

(Continued from page 61)

staff of Brown & Root, Inc., Houston, consultant and contractors for the project, for the expeditious manner in which this project has been prosecuted.

Features of the Inch System

Although Ingersoll-Rand built large centrifugal compressors for blast furnace blowers and other services for a number of years, the units for Texas Eastern had to be specially designed for high-pressure service. In fact they went on the drawing boards early in May. The first two assembled units arrived from the factory by truck at Little Rock early in September.

Because of existing electric and piping facilities, the Inch lines presented an unusually favorable opportunity for those who had the vision to exploit the advantages of the centrifugal-compressor principle. These inch lines are the Big Inch 1,254-mile 24 in. crude line and the Little Big Inch 1,470-mile 20-in. products line built in 1942 and 1943 by War Emergency Pipeline Co., managed by B. E. Hull and A. N. Horne, with Oscar Wolfe, chief engineer. By extensive use of centrifugal compressors with WEP equipment it is possible to achieve increased throughput earlier than would otherwise be possible. As far as possible Texas Eastern has utilized existing Inch line equipment.

The general arrangement of design features of the centrifugal compressors for this project has been planned so as to facilitate interchangeability of pumps and compressors. The internal design of the compressors is similar to that of the pumps except that dimensions and shapes of various parts have been made suitable for the gas and power requirements.

Each compressor is mounted on the pump sole plate and coupled to the driving motor in the same manner as the pump which the compressor replaces. Compressor dimensions are somewhat less than 6 ft. from flange to flange and less than 5 ft. high. The shaft is 4 in. in diameter.

Enters Single Inlet Opening

Gas enters a single inlet opening and passes through a double channel to either side of the double-inlet impeller in the conventional manner. The resulting pressure of the complete unit is obtained from the centrifugal action of the wheel and the conversion of the high-velocity gas leaving the wheel in the surrounding volute. Labyrinth glands seal the eye of the impeller to reduce short-circuit losses from its periphery to its inlet.

The gas-compressor discharge connection is located in the lower half casing in line with and opposite to the intake connection. This permits removal of the upper half casing without breaking the gas lines.

The shaft seals, which prevent gas from escaping to atmosphere, are of hydraulic type designed for full line pressure. A collar rotates with the shaft between two stationary sleeves. Oil at a pressure established by the gas pressure is pumped to the seals for both cooling and lubrication. This system is complete with main and auxiliary pumps, coolers, equalizers, and oil reservoir. Provisions have been made to maintain automatically oil pressure on the seals during periods of electric interruptions.

The lubricating system for the bearings consists of a main oil pump driven from the compressor shaft, and a motor-driven auxiliary pump which automatically starts and stops as needed. The system contains cooler, strainer, and reservoir.

Compressor Formula

The solution of problems in determining the effect of factors on the performance of a centrifugal compressor is obtained by the following commonly used fundamental formula:

$$W^2 = \frac{1{,}725 \times T_1 \times b}{S \times \mu \times S.G.}$$

W = peripheral velocity of wheel, ft./sec.
T = intake temperature, °F. absolute
S = number of stages
μ = pressure coefficient
S.G. = specific gravity

Where

$$b = \frac{n}{n-1}\left[\left(\frac{P_2}{P_1}\right)^{n-1/n} - 1\right]$$

P_2 = discharge pressure, psia.
P_1 = initial pressure, psia.
N = ratio of specific heats

Power required to drive a centrifugal gas compressor is determined by the following formula, based on adiabatic compression:

$$\text{Theo. Hp.} = \frac{144}{33{,}000} \times Q \times P_1 \times \frac{n}{n-1}\left[\left(\frac{P_2}{P_1}\right)^{n-1/n} - 1\right]$$

$$\text{Hp. at compressor coupling} = \frac{\text{Theo. Hp.}}{e}$$

where
Q = inlet c.f.m.
P_1 = inlet pressure, psia.
P_2 = pressure, psia., at compressor discharge
n = ratio of specific heats
e = centrifugal compressor efficiency, based on adiabatic compression

The Inch line centrifugal compressors operate at the low compression ratio of 1.3 in marked contrast with the more common pipe-line ratios of 1.6 to 2.00. Present suction pressure at the Little Rock station is approximately 550 psi. Upstream there are no compressor stations in the 150-200 mile sections of the crude and products line back to the field line connections. Pressure rise in the case of each compressor is 60 to 70 psi., giving a total of 180 to 210 psi. for three units operating in series. Discharge line pressure is approximately 750 psi.

Temperature rise in the case of each unit is 16° to 20° F. giving a total of 48° to 60° F. for three units in series. Temperature of gas in the suction lines at Little Rock is approximately 64° F.; in the discharge lines 90° F.

Heat developed in the small temperature rise due to the low compression ratio is dissipated as the gas passes through the underground lines.

In the present program for equipping 21 stations to deliver 433,000,000 cu. ft., no installations of gas-cooling equipment are contemplated at either centrifugal or reciprocative stations. At inch-line reciprocating stations only lubricating oil and jacket water are cooled.

The mechanical hydraulic shaft seal equipment is the heart of the centrifugal compressor. A vital factor in the functioning of this mechanism is the circulation and cooling of the seal oil, a light product designated as D.T.E., or turbine oil. In each compressor plant there is 200 gal. of seal oil which is circulated through coolers and equalizers at the rate of 60 g.p.m. Heat transfer in the oil coolers is effected by circulation of water from a fin-type cooler located midway between the crude and products plants, to serve both of them. The fin coolers are equipped with two air-circulating fans which are more than ample for reducing circulating water temperature the required 10°-15° F. In centrifugal pumps for fluids, mechanical seals present no such cooling problems as are encountered in centrifugal compression because the liquid pumped both cools and lubricates. Incidentally it may be mentioned that the inch units have the first application of this particular type of seal which had been developed in the Ingersoll-Rand research program prior to the design of the Inch line compressors.

Seal-Oil System

The seal-oil system is broadly satisfactory. For several months work will be done to improve details. It is anticipated that eventually each unit will be equipped with an individual oil system, instead of the common circulating system for each station now used.

The only significant change in the piping was the construction of a common 500-ft. 24-in. suction header, laid aboveground, which receives gas from scrubbers and delivers to the crude and products plants. "Crude"

and "Products" are convenient names for Big Inch and Little Big Inch which will be used during gas-transmission operations. The existing 16 and 18-in. discharge lines of the products and crude plants continue to be used.

For obtaining test data, four meter runs have been installed on the suction system leading to the product plant at the Little Rock station. This product plant is being used for experimental purposes to obtain operating data. A flow nozzle has also been installed in the product suction system for data purposes. Duplicate instruments are installed to obtain data on all phases of operation at the products plant.

The crude and products stations are balanced through an equalizer line connecting the 20 and 24-in. stations. For a while the crude and products plants were operated in series but normal operation of them is in parallel. Piping provides for flexibility which enables the plants to receive gas from the 20-in. or the 24-in. individually or compounded from the common header. Within each plant the three units can be operated in various combinations.

Centrifugal pumps removed from the plants and the motors removed from the crude plants are stored in a heated warehouse. Texas Eastern is removing the slower-speed 'crude" motors since it is standardizing on the product plant motors of 1,250 hp., 3,600 r.p.m., 2,300 volts, induction type. Motors for the crude-oil stations are obtained by transfer from stations where centrifugals are not to be installed.

It is intended to regulate small variations of flow through manipulation of the reciprocating stations, thus avoiding expensive throttling of the centrifugal stations.

Project in Two Steps

The Inch lines were transmitting without compressors at the rate of 120,000,000 cu. ft. daily during the first part of this year. The program for raising capacity entails equipping five stations with reciprocating units having a total of 36,000 hp., and 16 stations, with centrifugal units of 117,500 hp. Thus centrifugals comprise 76 per cent of the total of 153,500 hp. for the 433,000,000-cu. ft. program. This program for equipping a total of 21 stations is carried out in the two stages.

The first stage, now in progress, for equipping 10 stations with a total of 71,750 hp., (3 reciprocating and 7 centrifugal stations) is scheduled for completion next month.

The second stage of the program calls for equipping 11 additional stations with a total of 81,750 hp. By August 1, 1948, all of the 21 stations are scheduled for completion and operation to deliver approximately 433,000,000 cu. ft. at discharge pressures of 750 psi. at each station.

The reciprocating units scheduled for five stations are being utilized because cost or availability of electric power at some locations does not warrant the installation of centrifugal units and because of advantages afforded through providing flexibility for the operation of the system.

The 21 stations being equipped with compressors in 1947 and 1948 include the following of centrifugal type: No. 2, Atlanta, Tex.; No. 4, Donaldson, Ark.; No. 5, Little Rock; No. 6, Bald Knob, Ark.; No. 7, Egypt, Ark.; No. 8, Fagus, Ark.; No. 10, Lick Creek, Ill.; No. 12, Princeton, Ind.; No. 14, Seymour, Ind.; No. 15, Batesville, Ind.; No.16, Lebanon, Ohio; No. 17, Circleville, Ohio; No. 18, Crooksville, Ohio; No. 19, Sarahsville, Ohio. Also station F, El Dorado, Ark.; and Station G, Fordyce, Ark. Reciprocating stations in the program are: Station E, Castor, La.; No. 3, Hope, Ark.; No. 9, Oran, Mo.; No. 11, Norris City, Ill.; and No. 13, French Lick, Ind.

Two dispatchers' offices are operating. The one at Little Rock station controls deliveries to the Inch system. The Somerset, Ohio, office controls deliveries to customer connections.

Gas delivered to the line is received at connections in the Longview, Tex., area and in North Louisiana. Most of the deliveries are made in the Ohio River area and in western Pennsylvania.

Oil Prospects of China And the Carbon Ratio

(Continued from page 46)

of basalt, each containing bitumen in the amygdules of the lower part similar to the surface indication. Pebbles of the amygdaloidal basalt containing bitumen were found also in the basal conglomerate of the middle Jurassic, with pieces of solid free bitumen as large as 2 in. in diameter. At a depth of 370 ft. some very thick oil was found but it was too thick to be pumped. Either the bitumen and oil are brought up with extruding basalt, or the oil has migrated through a fault in the igneous group from an assumed underlying petroliferous formation which has not yet been directly proved.

In the middle portion of the geosynclinal belt, there are also a few sedimentary basins. A general picture is given by L. G. Weeks of Standard Oil Co. (N.J.). However, no direct surface indication is known in the area. This is probably due to the extensive cover of delta deposits by the major rivers. Aside from the Paleozoic possibilities, it is suspected that the marine Cretaceous or Tertiary in the gulf coast of Po-Had may be found under the cover of the overdrift.

At the southwest of the zone, several oil seepages are known. They are found in quite different formations. Oil traces are found in the continental Tertiary, marine Triassic, and Silurian beds, at different places. Little attention has been paid to such indications.

The third major zone of low metamorphism is along the coast and the islands. The coast of the mainland is mostly built of Paleozoic and Mesozoic rocks. Only one direct indication of oil is reported, in the Chang-hsing coal mine. The 27°-gravity A.P.I. dark brown oil is collected in a crosscut, from the Permian coal measure.

In the island of Tai-wan (Formosa) formations older than the Tertiary are not definitely known. The metamorphosed rocks in the high range which forms the backbone of the island may belong to the early Tertiary. The foothills consist of the less-altered Tertiary sediment, partly covered by Quarternary deposits. The carbon ratio, revealed by the Tertiary coal measures, shows a low metamorphic belt at the western part of the island.

Japanese Control

The oil fields of the island were brought under the control of Imperial Oil Co. of Japan when it was established in 1941, principally by absorbing the interests of Nippon Oil Co. No new field has been discovered during the last few years. Prior to the end of the war, little information was available. After a brief survey conducted by Glen M. Ruby in 1945, such information as was available was published by Leo W. Stach. It is reported that the average daily production is less than 30 bbl. a day. The coastal flat, which is much covered by the Quarternary deposit has not received its due share of interest.

The general geological condition of Hai-nan island is not sufficiently well known to judge. It is possible that the marine Cretaceous is exposed along the coast of the island. Fossils of probable marine Cretaceous type, quarried from the Hai-nan island, are sometimes sold in Peiping drug stores.

Summarizing the above facts it seems the northwestern areas are more promising as oil prospects, but lack transportation for development. A railroad may be a prerequisite for important development. On the other hand, the other prospective zones have less-favorable indications but easier accessibility.

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STATISTICS and T

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JANUARY 17, 1948

	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1948				
	Comp.	Oil	Gas	Dry	Footage	1948	1947	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	35	18	0	*17	35,002	109	80	0	0	0	0	0	0	0	0	0	0
Pennsylvania	87	38	7	†32	107,602	197	178	0	0	0	0	0	0	0	0	3	3
West Virginia	17	2	12	‡3	46,249	39	35	0	0	1	2	3	0	0	4	7	11
Ohio	24	7	6	§11	75,779	67	78	1	0	0	1	2	1	0	1	1	3
Indiana	16	7	0	9	31,332	42	26	0	0	0	0	0	0	0	0	0	0
Kentucky	13	3	2	8	19,393	38	29	0	0	0	0	0	0	0	0	1	1
Illinois	41	23	0	18	98,439	133	127	2	0	0	7	9	3	0	0	21	24
Michigan	10	5	0	5	21,017	55	50	0	0	0	4	4	0	0	0	21	21
Kansas	56	27	8	21	182,464	154	154	0	0	0	9	9	1	0	0	10	11
Neb., Mo., Iowa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oklahoma	89	47	6	36	325,279	193	239	3	0	1	24	28	7	0	3	38	48
Texas	217	125	10	82	908,024	585	419	8	0	3	46	57	20	0	4	126	150
North Central (Dist. 7-B & 9)	57	29	0	28	168,056	174	138	4	0	0	7	11	12	0	0	46	58
West (Dist. 7-C & 8)	64	51	0	13	297,272	156	107	2	0	0	8	10	2	0	0	10	12
Panhandle (Dist. 10)	10	6	2	2	29,204	35	24	0	0	0	0	0	0	0	0	0	0
Eastern (Dist. 5 & 6)	10	5	1	4	50,411	34	26	0	0	0	4	4	3	0	0	8	11
Gulf Coast (Dist. 2 & 3)	35	16	4	15	210,142	93	95	1	0	2	10	13	2	0	2	28	32
Southwest (Dist. 1 & 4)	41	18	3	20	152,939	93	29	1	0	1	17	19	1	0	2	34	37
Louisiana	44	32	4	8	278,456	126	62	1	1	0	5	7	1	1	0	12	14
Northern	20	13	3	4	46,354	85	29	0	0	0	3	3	0	0	0	9	9
Southern	24	19	1	4	232,102	41	33	1	1	0	2	4	1	1	0	3	5
Arkansas	8	4	0	4	31,208	29	14	0	0	0	2	2	1	0	0	8	9
Mississippi	12	6	2	4	95,579	27	25	0	0	0	3	3	2	0	0	5	7
Southeastern States	1	0	0	1	5,477	2	4	0	0	0	1	1	0	0	0	2	2
Montana	8	5	0	3	22,981	19	11	1	0	0	0	1	1	0	0	1	2
Wyoming	13	12	0	1	46,124	27	17	1	0	0	1	2	3	0	0	1	4
Colorado-Utah	4	4	0	0	25,756	20	11	0	0	0	0	0	0	0	0	1	1
New Mexico	16	15	0	1	50,360	46	27	0	0	0	1	1	0	0	0	1	1
California	48	40	1	7	165,533	126	113	0	0	0	7	7	1	0	0	14	15
Total United States	739	410	58	271	2,572,054	2,034	1,701	17	1	5	113	136	41	1	12	273	327
Total previous week	671	382	45	244	2,263,182	1,295	1,159	18	0	3	94	115	24	0	7	160	191
Total January 18, 1947	542	297	48	197	1,911,635			13	0	0	75	88	29	0	3	224	256

Service wells included: *17, †30, ‡1, §2.

CRUDE PRICES AND REFINERY ACTIVITY

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Tex.†	West Tex.‡
18-18.9	$2.17			
19-19.9	2.19			
20-20.9	2.21	$2.25		$2.12
21-21.9	2.23	2.27		2.14
22-22.9	2.27	2.29		2.16
23-23.9	2.30	2.31		2.18
24-24.9	2.34	2.33	$2.56	2.20
25-25.9	2.38	2.35	2.58	2.22
26-26.9	2.41	2.37	2.60	2.24
27-27.9	2.45	2.39	2.62	2.26
28-28.9	2.49	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.56	2.45	2.68	2.32
31-31.9	2.59	2.47	2.70	2.34
32-32.9	2.62	2.49	2.72	2.36
33-33.9		2.51	2.74	2.38
34-34.9		2.53	2.76	2.40
35-35.9		2.55	2.78	2.42
36-36.9		2.57	2.80	2.44
37-37.9		2.59	2.82	2.46
38-38.9		2.61	2.84	2.48
39-39.9		2.63	2.86	2.50
40 and above		2.65	2.88	2.52

†For crude from Daboval, El Campo, and Sand Point. ‡Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT, WEEK ENDED JANUARY 10

(Thousands of barrels)

District—	Crude runs, daily avg.	Production: Gasoline†	Kerosine	Gas & dist. oil	Residual	Stocks at refineries, bulk terminals, in transit and in pipe lines: Gasoline*	Kerosine	Gas & dist. oil	Residual
East Coast	757	1,900	232	1,461	1,480	20,017	5,531	11,674	7,582
Appalachian:									
District 1	99	314	74	85	95	2,205	285	601	416
District 2	74	223	24	77	91	1,089	117	289	170
Ind., Ill., Ky.	906	3,020	468	1,024	1,157	18,627	2,348	6,704	5,032
Okla., Kans., Mo.	452	1,504	185	568	517	8,671	843	2,909	1,655
Inland Texas	246	1,049	135	149	387	3,407	489	460	730
Tex. Gulf Coast	1,243	3,768	663	2,145	1,673	17,503	2,063	7,139	6,993
La. Gulf Coast	420	1,133	271	789	508	5,058	1,357	2,430	1,784
N. La. and Ark.	79	212	56	86	128	1,503	405	411	155
Rocky Mountain:									
New Mexico	12	37	4	11	27	88	25	21	34
Other Rocky Mtn.	149	458	37	163	302	2,146	143	794	662
January 10, 1948	5,289	16,289	2,290	7,471	8,776	96,698	14,536	46,785	51,935
January 3, 1948	5,637	17,163	2,346	7,405	9,392	94,099	15,983	‡49,934	‡51,426
January 11, 1947	4,708	14,694	1,971	5,587	7,805	95,000	15,959	55,617	50,789

*Finished and unfinished. †At refineries including natural blended. ‡Revised in East Coast.

Bureau of Mines crude-oil stocks 219,998,000 bbl. as of January 10—down 227,000 bbl. One year ago 220,553,000 bbl.

FLAT CRUDE PRICES

Representative posted schedules per bbl.	
East Texas	$2.65
Kettleman Hills, California*	2.14
Beauregard Parish	2.80
Illinois Basin	2.77
Pecos County, Texas (Yates)	1.85
Bradford, Pennsylvania	5.00
Eastern Ill. and Western Ind.†	2.77
Tomball, Texas Gulf Coast	2.83

*37°-37.9°. †36° and above.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

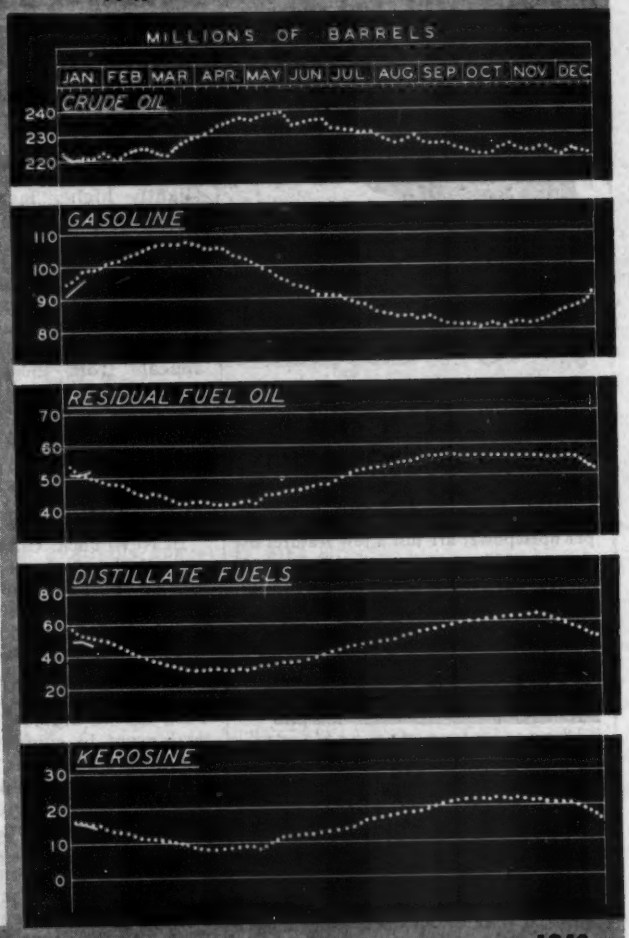
	Jan. 17 crude oil	B. of M. Jan. demand	Jan. 10 crude oil
Alabama	1,350	1,500	1,350
Arkansas	85,800	82,000	88,250
California	933,600	930,000	931,400
Colorado	46,640	47,000	45,690
Eastern	62,800	64,900	62,000
Florida	875	1,000	725
Illinois	170,400	185,000	175,800
Indiana	17,200	16,000	18,200
Kansas	294,550	306,000	271,750
Kentucky	27,100	26,000	27,100
Louisiana	473,150	453,000	474,950
North Louisiana	119,150	.....	120,950
South Louisiana	354,000	.....	354,000
Michigan	44,490	45,000	46,580
Mississippi	110,400	106,000	113,600
Montana	25,090	24,000	24,900
Nebraska	500	600	500
New Mexico	123,100	125,000	123,100
Oklahoma	407,000	405,000	406,400
Texas	2,385,700	2,310,000	2,385,700
Dist. 1 (Southwest)	25,600	.....	25,600
Dist. 2 (Southwest)	168,350	.....	168,350
Dist. 4 (Southwest)	255,500	.....	255,500
Dist. 3 (Gulf Coast)	496,750	.....	496,750
Dist. 5 (Eastern)	44,125	.....	44,125
Dist. 6 (Eastern)	120,875	.....	120,875
East Texas Field	294,500	.....	294,500
Dist. 7-C (West)	42,875	.....	42,875
Dist. 8 (West)	659,250	.....	659,250
Dist. 7-B (W. Central)	42,950	.....	42,950
Dist. 9 (N. Central)	142,725	.....	142,725
Dist. 10 (Panhandle)	92,200	.....	92,900
Wyoming	131,390	127,000	131,150
Total United States	*5,341,135	5,255,000	5,329,145
Change from prev. wk., up	11,990		

Total production January 1-January 17 . . . †91,267,280 bbl.
Same period last year (crude plus cond.) . . 78,843,055 bbl.

*Not incl. 47,730 bbl. condensate. †Incl. 811,410 bbl. condensate.

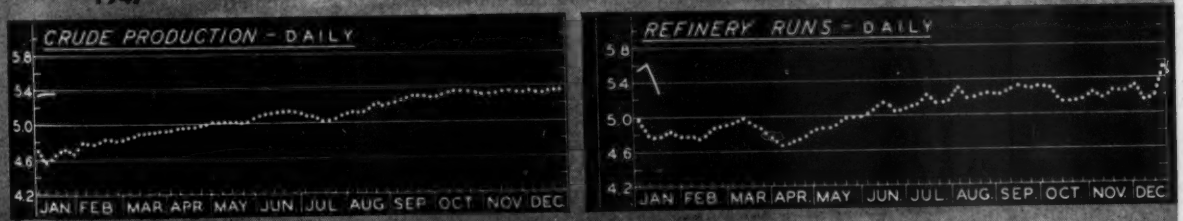
STOCKS IN UNITED STATES

---- 1947 ——— 1948



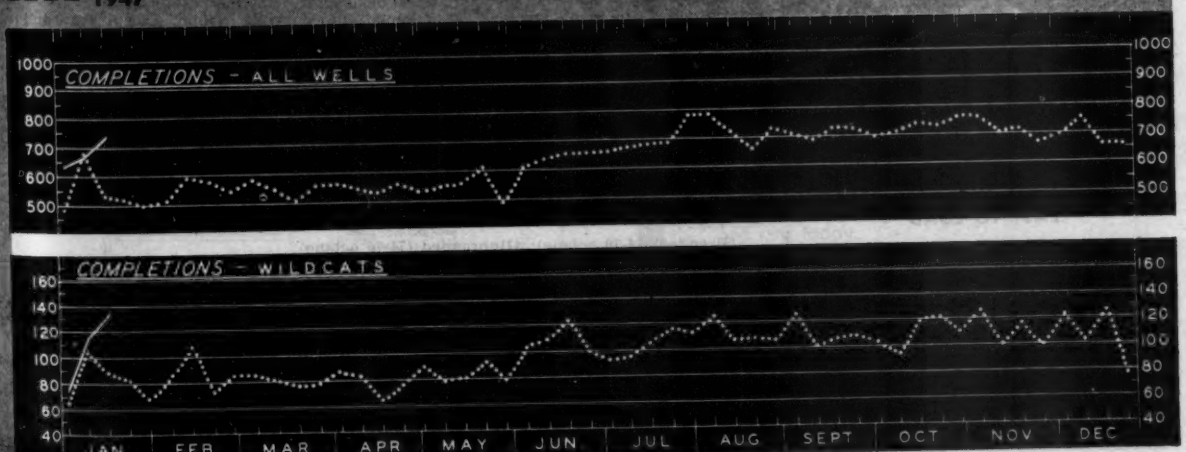
DAILY OPERATIONS

---- 1947 ——— 1948



WEEKLY COMPLETIONS

---- 1947 ——— 1948



DESIGNED for UNIVERSAL USE

The new Model "75," incorporating the latest developments in engine design, is now in service where wide horsepower range and dependability are required.

Meehanite cast iron cylinder block, insert connecting rod bearings, Timken main bearings, air maze oil bath and low weight per horsepower are just a few features of the new "75."

ORDER NOW FOR PROMPT DELIVERY

For further information write:

Gladden Products CORP.

"28 years of engine building"

6351 West Colorado Blvd., Glendale 4, Calif.

CUT TALL GRASS... WEEDS...BRUSH Faster and Easier

The JARI Power Scythe is ideal for fast clean mowing around storage tanks, pipe lines, buildings, fences, and in tight corners.

Very easy to handle on rough ground, steep slopes or hard to reach places. Cuts 1½" from ground. Does work of 8 men.

EASY TO LOAD

Light weight of JARI makes it easy for one man to load into truck or car trunk for quick moving. Rugged. Dependable.

WRITE TODAY FOR *FREE* FOLDER

JARI PRODUCTS, Inc.
2936-O Pillsbury Ave.
MINNEAPOLIS 8, MINNESOTA

MARKETS

A CONFUSED price situation throughout New England and New York began to straighten out last week as several major suppliers in this area advanced prices on kerosine and light fuel oils up to the slightly higher level that has been maintained by other leading suppliers.

Meanwhile, the light and heavy-fuel-oil supply situation along the eastern seaboard was reportedly getting worse. Continued cold throughout this area brought forth urgent appeals from those quarters experiencing fuel scarcities. Concern was expressed in these same areas as to the possibility of obtaining supplies that would be needed sorely in the 2 months ahead.

Urge Tanker Release

In New York, Governor Dewey has organized a fuel committee to advise him on the situation and to see what can be done to expedite deliveries. The fuel advisory committee is urging Washington to release more tankers and has suggested construction of a products pipe line within the New York harbor area. It is urging industrial users to convert to coal where too much steel would not be involved.

Little change was noted in the Mid-Continent area, with all products movements still remaining tight. No appreciable letup in gasoline demand was reported and one observer saw in this a stronger pinch in gasoline supplies than is generally expected for consumers next spring. One supplier pointed out gasoline movements were reported bringing 3½ to 4½ cents above posted prices on spot sales. Most sales were carried out through use of buyers' cars, as tank cars continued to be scarce and suppliers were careful to prevent tying them up for any length of time.

Very definite conservation measures came out of Washington early this week as the President directed federal agencies to use "every means of conserving fuel oil, gasoline, and gas." And at Westover Field, Mass., the brownout and the rationing of gasoline were resumed.

Gulf Prices Up

In the Gulf Coast area publication and contract postings were unchanged, but continued heavy demand appeared to be forcing other prices still higher, as some petroleum products moving on the open spot market were advanced slightly.

Strongest and scarcest items in the market were kerosine and No. 2. Offers of No. 2 as high as 13 cents were reported, though unconfirmed. One marketer said he was offering third-grade gasoline at 11¾ cents and was prepared to pay $3.50 for No. 6 residual. Lubricating-oil prices in the South Texas area were up 2 and 3 cents on the low quotation for several important grades.

Movement of a cargo of 70-72-octane gasoline at 13¼ cents also was reported.

Secretary of the Interior J. A. Krug called on the nation to make a cutback in the use of gasoline, fuel oil, and natural gas to meet the "critical" supply situation. A 15 per cent nationwide reduction in demand is necessary, he said.

A nation-wide, 50-city gasoline-price tabulation as of January 1 showed that service-station prices for gasoline, including taxes, averaged 25.64 cents per gallon, an increase of 1.49 cents from a month earlier, and represents the highest price since 1921.

Representative Quotations

Representative spot-market quotations of leading suppliers as of January 19, 1943. Figures are f.o.b. plant for tank-car shipment in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor	Texas Gulf Coast
Regular gasoline, 73-75 octane	10½-11½	11.6-12* 10.5-12.2†	10.9-13
Premium gasoline, 78-80 octane	11¾-12½	10.6-13.4	12.9-13½
42-44 w.w. kerosine	10-10½	9.8-10.8	10¼-12
No. 2 straw fuel oil	9½-11	8.9-9.9	9.05-11½
No. 6 residual	$2.50-2.90	$3.03-3.90	$2.56-3.50

*Branded (74-76 octane); †Unbranded (74-76 octane).

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	8½	8	8¼
Grade 18-55	10.2	9.6	9.9

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13-14.5
750 vis., No. 3-4 neutral	15-17.25
2,000 No. 5-6 neutral	17-18½

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	30-33
200 vis. No. 3 neutral, 0-10 pp.	20-21

Western Pennsylvania

145-155 vis. 10 p.t. bright stock	47
180 vis. p.t. neutral	46

CRUDE-SCALE WAX

Mid-Continent

130-132 A.S.T.M. melting point	8½-9¼

Empire Trust Company

NEW YORK

Capital Funds..... $8,781,266.76
Total Resources..... $131,269,144.24

Directors

Dean Mathey
Chairman of the Board

Henry C. Brunie
President

Frank V. Baldwin
Retired

Ned G. Begle
Retired

Everette L. DeGolyer
DeGolyer & MacNaughton
Dallas, Texas

George A. Easley
Vice President, Salt Dome Oil Corp.

Dean S. Edmonds
Pennie, Edmonds, Morton & Barrows

Charles S. Garland
Alex. Brown & Sons
Baltimore, Maryland

Archibald A. Gulick
Alexander & Green

Paul H. Hudson
Executive Vice President and Secretary

Graham D. Mattison
Dominick & Dominick, New York

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Specialized experience is available for study and suggestions as to sound financing of oil properties.

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MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

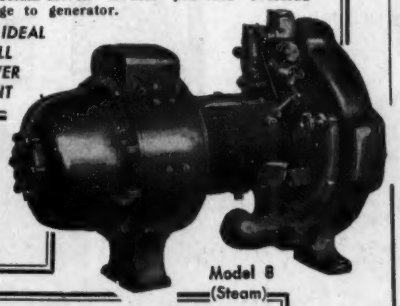
MOON Generators
TURBO and BELT DRIVEN
for LIGHT and POWER

IMPORTANT FEATURES

- GOVERNOR AND COMPOUND WINDING on steam-driven models prevent excess voltage output which might injure electrical equipment.
- ONLY 2 EASY-TO-REACH OILING POINTS.
- AUTOMATIC CUT-OFF on larger capacity steam-driven models prevents overload damage to generator.

THE IDEAL SMALL POWER PLANT

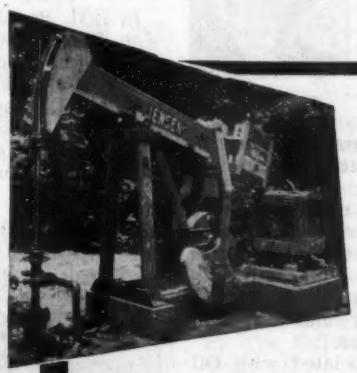
SEND TODAY FOR ILLUSTRATED CIRCULARS . . . MODELS FROM 1 to 7½ KW. CAPACITY . . .



Model 8
(Steam)

• *Send in your old Moon Generators for rebuilding now . . . . prompt service.*

Moon MANUFACTURING CO.
ESTABLISHED 1893
116 NORTH JEFFERSON ST., CHICAGO 6, ILLINOIS, U.S.A.



Does JENSEN Offer Something for Nothing?

Maybe it depends on how you look at it. Actually, there's no such thing as "something for nothing" in the oil business. But Jensen does offer you more value for your money.

To begin with, you have a low initial cost when you buy a Jensen Pumping Unit. And there's a real saving in Jensen's lower maintenance costs, reduced power bills, and less "down time".

Let your Jensen dealer show you how Jensen's extra values can make more profits for you. See him today.

JENSEN Bros. Mfg. Co.
Coffeyville, Kansas, U. S. A.
Export Office: 50 CHURCH STREET, NEW YORK CITY

EQUIPMENT MEN ... in the News

Sales Changes in Oil Well Supply

M. F. Hazel of Dallas has been appointed general manager of sales

M. F. HAZEL

K. B. WINSTEAD

for Oil Well Supply Co., U. S. Steel Corp. subsidiary.

K. B. Winstead, also of Dallas,

V. J. WATERS

C. A. BELL

has been named assistant general manager of sales, with headquarters in Dallas.

V. J. Waters was named manager of the central midwest division of Oil Well Supply with headquarters in Dallas.

C. A. Bell was appointed manager of drilling equipment sales, also with headquarters in Dallas.

Hazel became associated with Oil Well Supply Co. in 1930 as service engineer. From 1930 until 1943 he served in various capacities in East Texas and Oklahoma, becoming sales manager for both the West Texas and the East Texas-North Louisiana-Arkansas districts. In 1941, he was assistant division manager at Houston. In 1943 he entered the United States Navy with the rank of lieutenant. He returned to Oil Well Supply in 1946 as assistant to the vice president.

Winstead became connected with Oil Well Supply in 1921, and has been located at Fort Worth, Breckenridge, Wichita Falls, and at Dallas. He has served in various capacities, in 1946 becoming manager of the then central midwest division.

Waters came into the Oilwell organization in 1919. He has served at Cushing, Wynona, Bryant, Shidler, Okmulgee, Wewoka, and Tulsa, Okla., and has been stationed in Dallas since 1932.

Bell began work with Oilwell in 1924. He has been associated with the company at Stroud, Seminole, Maud, Wewoka, and Earlsboro, Okla., and at Houston and Dallas.

Bowlby Elected to Board of Directors

Joel M. Bowlby, president of Eagle-Picher Co., Cincinnati, has been elected to the board of directors of the Federal Reserve Bank of Cleveland for the unexpired term ending December 31, 1948.

Bowlby, a native of Litchfield, Ill., has been at the head of Eagle-Picher since 1941. He began his business career with Railway Steel-Spring Co., now a division of American Locomotive Co. After 8 years of varied experience in the commercial and investment banking business, he served in the U. S. Army during World War I, both at home and abroad.

In 1921, Bowlby became associated with Barrow, Wade, Guthrie & Co., accountants and auditors, and remained a general partner of that firm until 1941, when he assumed the presidency of Eagle-Picher Co., manufacturers of lead, zinc, insulation, paints, and industrial pigments.

Dunbar Appointed By American Hoist

Appointment of Robert C. Dunbar, as West Coast representative, is announced by American Hoist & Derrick Co. He will represent the small - products division. Products covered by the small - products division include Crosby Clips—drop-forged fasteners for wire rope, blocks and sheaves, and Handiwinch.

Dunbar was formerly connected with the steel and tube division of Republic Steel Corp., and more recently engaged in sales work on the West Coast. Dunbar will probably headquarter in San Francisco.

Kehde Joins Foster Wheeler

Howard Kehde, formerly with Union Oil Co. of California, has joined Foster Wheeler Corp., New York, in charge of process engineering of hypersorption units. While with Union Oil he assisted Dr. Clyde Berg in development of all phases of the hypersorption process since its inception. He also assisted in the direction of the startup operations of the first hypersorption unit.

New portable field laboratory, largest ever built by Core Laboratories, Inc., Dallas, has been designed and equipped to analyze simultaneously for oil and gas content 60 ft. of subsurface formations in Rangely field and the Rocky Mountain area. Planned and constructed at a cost of $10,000 under the direction of John D. Wisenbaker (in door), manager of operations, the all-aluminum trailer-type lab measures 28 ft. in length and weighs 6,000 lb. James D. Harris, district engineer, will supervise continuous 24-hour service in the new unit of the company's fleet of 22

Three Cooper-Bessemer Executives Promoted

J. W. REED

Cooper-Bessemer Corp., Mount Vernon, Ohio, has announced the elevation of three of its sales executives to positions of vice president.

Those so honored, in recognition of their outstanding sales achievements and their many years of service, include J. W. Reed, the company's Atlantic Coast manager of gas engine and compressor division; A. A. Burrell, South-

A. A. BURRELL

B. L. POTTER

western district manager, with headquarters in Dallas; and B. L. Potter, Mid-Continent manager with headquarters at Tulsa.

Reed, a Cooper-Bessemer veteran of 25 years' service, served the company as Pacific Coast manager from 1925 to 1940 when he assumed his present position in New York. Reed is regent of the New York chapter of Nomads and is also a member of the California Gasoline Association.

Burrell joined Cooper-Bessemer on January 1, 1925, when it was C. & G. Cooper Co., and has been Southwestern district manager since that time. He is a member of the Dallas Petroleum Club, the Petroleum Engineers Club, the Dallas Country Club; is vice president of the Dallas Chapter of Nomads, and holds membership in the American Institute of Mining and Metallurgical Engineers.

Potter will soon complete his thirty-fifth year in the engine-building industry. He joined Bessemer Gas Engine Co. in January 1913 and was in charge of its Mid-Continent area in 1929 when the company merged with C. & G. Cooper Co. to become Cooper-Bessemer. Since that time Potter has occupied the position of branch manager of the Tulsa office.

U. S. Steel Names Estes

Bay E. Estes, Jr., has been appointed director of commercial research, United States Steel Corp. of Delaware. He succeeds Kemp G. Fuller, who has resigned. Estes joined the commercial research division of the Delaware corporation in 1939. He was made assistant manager of the division in 1943.

MacClatchie Celebrates Twenty-five Years

The end of 1947 rounded out a quarter century of service to the oil industry by MacClatchie Manufacturing Co., Compton, Calif. The growth of this firm from its start in 1922, in a one-car-garage structure in Brea, Calif., to its present complete plant in Compton is a story of pioneering and growth which parallels the rise of the petroleum industry.

The MacClatchie firm was first to introduce many of the important features of present day mud pump valves and pistons, including such features as the hardened and ground valve seat, the cup-type replaceable piston rubbers, and similar improvements.

The firm is still headed by its founder, J. Warren MacClatchie, who initiated the original business to manufacture oil-field specialty items. In 1923, only a year after the firm's beginning, MacClatchie realized that the fast-growing petroleum industry would require increased specialty tool facilities, and he moved the plant to Compton.

McAlister Joins Mid-Continent Supply

Edward McAlister, formerly with Mene Grande Oil Co., C.A., at Maracaibo, Venezuela, has rejoined Mid-Continent Supply Co. where he worked for 6½ years before the war in Fort Worth and other Texas locations. McAlister is now stationed in New York as a sales engineer.

R. E. ELMORE

Robert E. Elmore, export manager of Mid-Continent Supply Co., recently returned to the United States after a 3-week business trip to Buenos Aires, Argentina. Just prior to the Argentina trip, Elmore had been in Switzerland and in England.

Cameron Enters Cementing Equipment Field

Cameron Iron Works, Houston, has announced the purchase of all of the fixed assets of Nuwell Tool Co., also of Houston.

Nuwell Tool Co., under the terms of the purchase will be dissolved and the Nuwell line of Flomaster float collars, float shoes, and other cementing equipment will be manufactured and marketed by Cameron Iron Works.

Chain Belt Elects Three Vice Presidents

Chain Belt Co., Milwaukee, announces the election by the board of directors of three vice presidents.

L. B. McKnight, who joined the company in 1927, has been elected vice president with executive responsibility for the two heavy-machinery divisions, conveyor and process equipment, and the construction machinery. McKnight was executive assistant to the president of the company and previously was manager of the conveyor and process equipment division.

O. W. Carpenter has been elected a vice president of Chain Belt Co. in charge of finance. Carpenter was formerly secretary-treasurer and a director of the Kearney & Trecker Co., and came to Chain Belt in 1943.

B. F. Devine, elected vice president, started with Chain Belt Co. in 1909. He served as sales manager of the construction machinery division, and later as manager of that division. Devine will continue his duties as manager of the construction machinery division.

Brown Expands in Rocky Mountain Area

Brown Instrument Co. has expanded its sales and service activities in the Rocky Mountain area by establishing permanent sales and service representation at 400 Broadway, Denver, and 437 Atlas Building, 36½ West Second South, Salt Lake City.

Donald Larcen has been placed in charge of Denver industrial sales and George Winslow, formerly industrial service manager at Detroit, will handle similar duties in Salt Lake City, where he will work with Eldon Richardson, district manager.

The areas to be covered by the Denver branch will include all Colorado, Wyoming, and western Nebraska. The Salt Lake City district will cover all of Utah, southern Idaho, and western Nevada.

Johnston to West Texas

Tommy Johnston, general manager of M. O. Johnston Oil Field Service Corp., Los Angeles, is spending the month of January in West Texas and New Mexico in the interests of expanding service facilities for formation testing and "Shoot-N-Tests," new method of gun perforating and combined perforation and formation testing.

Classified Advertising

The Market Place for the Oil Industry

UNDISPLAYED

All ads, 10 cents a word. Minimum charge, $2.00 per insertion.
Centered Line, any ad, 75 cents.
Box Numbers count 9 words when replies are to be sent to our Tulsa Office. Replies forwarded without charge.

DISPLAYED, PER INCH

$10.00 per column inch per insertion. One-point border and 12-point capitals are allowed. Larger type sizes not accepted.

All classified advertising payable in advance.
10% Discount if 3 insertions are ordered at one time.
COPY DEADLINE, 9:00 a.m. Monday prior to each week's issue.

THE OIL AND GAS JOURNAL
P. O. Box 1260, TULSA, OKLAHOMA

EQUIPMENT FOR SALE

FOR CABLE TOOLS
DEGEN PIPE AND SUPPLY CO.
Box 107, Red Fork Station, Tulsa, Oklahoma

FOR SALE: 1 Cardwell Used Model "R" Double Drum Hoisting Unit with 165 HP Hercules HXE Engine (recent overhaul). Price $3750.00.
Lucey Products Corporation, Tulsa, Okla.

FOR SALE: 1 Model 55 Wichita Spudder complete with Cummins Diesel and Tools. 1 Model 61 Wichita Spudder complete with LeRoi engine and tools. Both rigs located in Crockett County, Texas. Phone 21 Iraan.

FOR SALE: Cardwell Model "R" Double Drum Drilling In Unit equipped with Buda Diesel Engine, 55 foot Telescope mast, seven and five inch tools, steel tool house, Kohler Light Plant and all miscellaneous tools. Phone, write or wire—Veeder Supply & Development Co., Cherryvale or McPherson, Kansas.

WELL drilling equipment for deep and shallow wells. Spudders, beams, light rotaries, core drills. Cable tools, casing. Leschen lines. Pressey & Son, Pueblo, Colorado.

1,150′ 13″ OD 50# SS Casing No. 1 used. 1—FRH Buda Engine. 1—U-9 International Engine. 1—VIK Waukesha Engine, all reconditioned. 1—31 HP Reda Pump w/ 3600′ Cable. RIGGS SUPPLY COMPANY, Union National Bank Bldg., Wichita, Kansas. Phone 5-4539.

FORT WORTH Jumbo J Spudder #1 condition w/ 10″ shear poles and Dunnigan Header w/ 165 Waukesha or 125 Caterpillar Diesel engine. Located North Texas district Bargain. 409 Bewley Bldg., Fort Worth, Tex. 3-1630.

NEW API BOLTED TANKS

3—10,000 bbl. at New York
1—5000 bbl. at Mobile, Ala.
25—1000 bbl. at New York
14—1000 bbl. at Mobile, Ala.
30—100 bbl. at New York
60—100 bbl. at New Orleans
247—100 bbl. at Stockton, Calif.

R. C. STANHOPE, Inc.
60 E. 42nd St., N.Y. 17, N.Y.

EQUIPMENT FOR SALE

FOR SALE at our Chase, Kansas, production office, 1 used Allis Chalmers Model U-6 Skid Type Well Servicing Winch, $1750. Cities Service Oil, Patridge, Bartlesville, Okla.

COMPLETE REFINERY: Topping Unit, Thermal Cracking Unit, all auxiliaries, with plans and specifications for installation. Responsible owner of stable crude supply can arrange some payments from proceeds of operation. Box C-176, The Oil and Gas Journal, Tulsa, Oklahoma.

HEAVY duty kelly rig, hydraulic lift mast, 4½ x 6 G. D. pump, chain pull down. Twin Disc clutches. Drill and tank mounted on 1944 Ford trucks. Will sell or lease. Waters Drilling Service, 69 Beacon Place, Pasadena 8, Calif.

FOR SALE:Three I. H. C. School Buses 1937-38-40 All Steel Bodies, Genuine leather upholstering, heaters, defrosters, flags, flares, fusees. 52 passenger buses. Good tires, excellent condition. Shultz Motor Sales, 390 W. Market St., Tiffin, Ohio.

1—15,000 Foot Power Rig Complete with Bethlehem MC-950 Draw Works with 4—383 HP 6 G-510 Superior Gas Butane Drilling Engines, 2 pumps. 1—12,000 Foot Power Rig Complete w/ Bethlehem MC-650 Draw Works with 3 LRO Waukesha Engines, 2 pumps. 1—12,000 Foot Steam Rig Complete w/ 14 x 14 Ideal Ajax Engine, #12 Beaumont Iron Works Draw Works, 3 20″ Pumps, 4 Boilers. Sharp Drilling Company, 625 Fort Worth Club Bldg., Fort Worth, Texas.

4,185′ 7″ 20 pound range 2 new seamless 8 round thread.
1,600′ 10¾″ 40 pound range 2 seamless, good as new.
3,600′ 5″ 17 and 20 pound seamless, good as new.
1,900′ 5½″ 17 pound used lapwell casing.
2,295′ 7″ 20 pound used lapwell casing.
1,500′ 8⅝″ 24 pound used lapwell.
1,300′ 10¾″ 35 pound used lapwell.
20,000′ 2″ used tubing lapwell.
Other varied sizes and weights oil well and water well casing and line pipe. New Mexico Steel Products Co., Wichita Falls, Texas. Phone 7881, Box 2135.

FOR SALE

3—100 h.p. 2 cycle twin cylinder Superior Gas Engines with direct connected compressors. 2 located near Albert, Kansas. Contact Ola Williams, 1 located near Garnett, Kansas. Contact Roy Williams.

SCHERMERHORN OIL CORP.
Kennedy Bldg., Tulsa, Okla.

NEW CENTRIFUGAL PUMPS
Boxed for Export

50 New Byron Jackson 3″, 2-stage Pickup Centrifugal Pumps, direct connected to C-36 Chrysler Engines, complete with spare parts, tools, and skid mounted.

VICTORY SUPPLY COMPANY
120 N. Elgin — Tulsa, Okla.

FOR SALE
MEATHERS PUMPING PACKERS
(Rubber cup type)

4⅞″	$18.50
6¼″	22.50
6⅝″	30.00
8¼″	45.00

Dealers Wanted. Write for information.

GEHLBACH MACHINE COMPANY
Box 323, Independence, Kans.

EQUIPMENT FOR SALE

4,000 FEET 20 foot length 4 inch drill stem with Acme tool joints on every joint $1.65 per foot. Stacked since last used in 1936. Interstate Minerals, Inc., Box 228, New Braunfels, Texas.

FOR SALE—Six gas engines for oil wells. Good condition. $350.00 each. Paxton Oil Syndicate, Stewart Bldg., Paxton, Illinois.

7—No. 3A6 National Drilling Machines with or without Tools and Power. Some of these practically new. Zanesville Tool & Supply Company, 18 Harrison Street, Zanesville, Ohio.

FOR SALE: At Hillsboro, Kansas. National Model 2000 core drilling rig rebuilt. Good condition. Mounted on 1944 Chevrolet truck. 36 foot mast, 4½ x 6 Gardner-Denver pump with new power end. Ben-Franklin Exploration, Inc., 303 Orpheum Building, Wichita, Kansas.

FOR SALE: One Rotary Drilling Rig powered with gas butane engines complete with portable derrick suitable for 4500′ work. Easy terms. Melton Supply Company. Box 1260, Seminole, Oklahoma

FOR SALE

2—125 H.P. 350# Working Pressure "OIL WELL BOILERS," EXCELLENT condition. Completely reconditioned. Not used since last approval by State Boiler Inspector. Priced to sell.

POWEL BRISCOE, INC.
1916 First National Bldg.
Oklahoma City, Oklahoma

NOW BEING DISMANTLED
ALKYLATE FACILITIES
ENID, OKLAHOMA

Towers — Pressure Vessels — Pumps—Instruments and Meters — Heaters — Condensers and Exchangers—Pipe and Tubing—Valves and Fittings.

Complete Inventory Available
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P. O. Box 887 — Thrasher Bldg.
Tulsa, Oklahoma — Telephone 2-6291

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OWNERSHIP Maps, Montana and Wyoming. Edwin Z. Snyder Map Service, Box 1868, Billings, Montana.

First-Quarter Allocations For Controlled Products

WASHINGTON. — First-quarter allocations to individual countries of the six controlled petroleum products were announced by the Office of International Trade January 16 on the heels of an order providing that, effective March 1, individual validated licenses will be required for the commercial shipment of any commodity to Europe.

The over-all quota had previously been announced as 12,000,000 bbl. of the six controlled products (aviation gasoline, motor gasoline, kerosine, gas oil and distillate fuel oil, residual fuel oil, and blending agents), but to this OIT has now added 45,000 bbl. of aviation gasoline for Greece and 2,425,000 bbl. of all products for Japan and the Ryukus, make a total export figure of 14,470,000 bbl. for the quarter, exclusive of shipments to Canada.

The exportation of fuel oil was protested by both Sen. Kenneth M. Wherry of Nebraska and Rep. John W. Heselton of Massachusetts, the latter declaring the department's action "utterly incomprehensible."

Analysis of the export figures, Heselton said, indicates that, including shipments to Canada, we will have exported by the end of March more than 600,000 bbl. of fuel oil in excess of last year's shipments.

Special Oil Committee In House Is Proposed

WASHINGTON.—Irked by the apparent slowness with which Chairman Charles A. Wolverton of the House interstate committee is prosecuting his investigation of the oil situation, Rep. Oren Harris of Arkansas plans to introduce a resolution authorizing the setting up of a special subcommittee to go into the subject.

When he introduces his resolution in the House, Harris plans to make a statement criticizing the manner in which the investigation has been conducted and urging that the committee be instructed to return to its former practice of assigning important subjects to subcommittees for study.

Dow to Speak for I.O.C.C. At Hearing on Tidelands

Implementing its fight against federal control of tidelands and other submerged oil properties, the executive committee of the Interstate Oil Compact Commission, meeting in Fort Worth January 16, appointed Hiram Dow of New Mexico, its past chairman, to represent the commission at a hearing before the Senate judiciary committee in Washington February 23 which will consider legislation to disclaim Government ownership of such lands.

Accepting an invitation from Gov. Dwight H. Green of Illinois, the committee voted to hold the spring quarterly meeting of the commission in Chicago April 28-30. The next meeting of the executive committee will be held in Dallas on a date early in March to be sent later.

Aramco-Navy Deal Again Aired by Senate Committee

WASHINGTON. — The Senate war investigating committee will take one last whirl at the Arabian American Oil Co. sale of oil to the Navy before it goes out of business.

Chairman Owen Brewster of Maine will hold a hearing January 23 at which Ralph K. Davies, former Deputy Petroleum Administrator for War, will testify about any part he may have had in the Arabian oil transactions and wartime oil prices. Davies had informed the committee that he disassociated himself from all matters involving Standard Oil Co. of California with which he had been associated and those matters were handled by Administrator Harold L. Ickes.

Brewster also announced that he would subpena Interior Secretary Krug to supply "certain missing papers," including a reported offer in 1943 by W. S. S. Rodgers, president of The Texas Co., to supply Arabian oil at cost plus a nominal profit if the Government would extend lend-lease aid to Saudi Arabia.

Mapes Opposes Change in Wage-Hour Regulations

WASHINGTON.—Change in Wage-Hour Law definitions which would have the effect of narrowing the definitions of exempt employes were opposed last week by Clarel B. Mapes, general secretary of the Mid-Continent Oil and Gas Association, at hearings before the Wage-Hour Division of the Department of Labor.

Mapes told the administrator the petroleum industry has adapted its operations to the present regulations and does not think it compatible with good and proper administration of the law to change salary qualifications with every change in economic conditions. Far from solving any problem, he contended, changes now would increase costs of operation, with further inflationary effect.

The nature of an employe's work, rather than salary, should be the determining factor in deciding his status under the law, Mapes declared, but if the salary test is to be continued in the regulations, the amount fixed should only be sufficiently above the minimum under the law to evidence the good faith of the employer in classifying his employes as exempt. The present amounts are sufficiently high for this purpose, he said.

Mapes also opposed any change in the amount of work of nonexempt character which an exempt employe may perform, explaining that such a change might necessitate costly modifications in record-keeping methods which he said are unnecessary.

Pan Am. Buys 12 Wells

HOUSTON.—Purchase of the New Idris Quicksilver Mining Co. oil producing properties in Wimberly and Reddin fields, Jones County, West Texas, by Pan American Producing Co. has been announced by E. R. Turner, Pan American president.

The properties consist of four leases covering slightly more than 275 acres with 12 wells, one a dual producer. Production is now about 350 bbl. daily. Consideration in the transaction was reported at approximately $1,000,000.

Fort Bend Producers Sold

HOUSTON.—Oil properties of Fort Bend Oil & Gas Co. in Fort Bend County in the Texas Gulf Coast area have been acquired by Lohman & Nysewander, Dallas, and consigned to Batewell Oil Co. and Crewsview Oil Co.

Consideration was reported to be about $3,000,000. Included were 14 producing wells in North Thompson field along with various undeveloped leases.

Gulf Coast A.I.M.M.E. Section Plans Meeting

HOUSTON.—The Gulf Coast section, American Institute of Mining and Metallurgical Engineers, has decided to hold a spring technical meeting in Houston, probably in May.

Harold Decker, section chairman said the exact date will be set to coincide with the visit to Houston of W. E. Wrather, director of the United States Geological Survey and A.I.M.E. president-elect. A number of technical papers are planned for presentation on the program.

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CALENDAR

January 1948

Western Petroleum Refiners Association, regional meeting, Washington-Youree Hotel, Shreveport, January 23.

Natural Gasoline Association of America, Gulf Coast regional meeting, Driscoll Hotel, Corpus Christi, January 30.

February

American Institute of Mining and Metallurgical Engineers, annual meeting, Pennsylvania Hotel, New York, February 15-19

Kansas Oil Mens' Association, annual meeting, Wichita, February 16-17.

March

Commercial Chemical Development Association, annual meeting and technical session, Roosevelt Hotel, New York City, March 9-10.

Oklahoma Utilities Association, annual convention, Biltmore Hotel, Oklahoma City, Okla., March 11-12.

Texas Independent Producers & Royalty Owners Association, annual meeting, Corpus Christi, March 12-14.

Natural Gasoline Association of America, annual convention, Texas Hotel, Fort Worth, March 24-26.

American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita, March 24-26

Southern Gas Association, annual meeting, Galveston, Tex., March 24-26.

April

Western Petroleum Refiners Association annual meeting, Galvez and Buccaneer hotels, Galveston, April 5-7.

Oil-Heat Institute of America, convention and exposition, Coliseum, Chicago, April 5-8.

National Association of Corrosion Engineers, fourth annual conference and exhibition, Jefferson Hotel, St. Louis, Mo., April 5-8.

Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla., April 13-15.

American Petroleum Institute, Division of Production, southwestern district meeting, Plaza Hotel, San Antonio, April 14-16

American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, and Society of Exploration Geophysicists, annual meeting, April 26-29, Shirley-Savoy Hotel, Denver.

American Society of Lubricating Engineers, annual convention, Statler Hotel, Buffalo, N. Y., April 19-21.

National Petroleum Association, Hotel Cleveland, Ohio, April 21-23.

Interstate Oil Compact Commission, spring meeting, Chicago, April 28-30.

May

Natural Gas Department, American Gas Association, annual spring meeting, Rice Hotel, Houston, May 4-5.

American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles, May 6-7

International Petroleum Exposition, Tulsa, May 15-22.

Gas Technology Short Course, sponsored by the Southern Gas Association, Texas A. & I. College, Kingsville, May 31.

June

American Society for Testing Materials, fifty-first annual meeting, Book-Cadillac Hotel, Detroit, Mich., June 21-25.

American Petroleum Institute, Division of Production, eastern district meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., June 30, July 1-2.

Canadian Gas Association, annual convention, Jasper Park Lodge, Jasper, Alta., June 30-July 3.

September

Pacific Coast Gas Association, annual convention, Hotel Casa del Rey, Santa Cruz, Calif., September 14-16.

October

National Lubricating Grease Institute, sixteenth annual convention, Edgewater Beach Hotel, Chicago, October 11-13.

Texas Mid-Continent Oil and Gas Association, twenty-ninth annual meeting, Fort Worth, October 14-15.

November

American Oil Chemists' Society, fall meeting and technical sessions, Pennsylvania Hotel, New York, November 15-18.

NOMADS

Houston Nomads, second Monday of each month, The Houston Club, Houston.

Los Angeles Nomads, second Wednesday each month, Jonathan Club.

NPC Meeting This Week Tackles Big Problems

WASHINGTON.—The National Petroleum Council meeting this week is scheduled to deal with more problems of the first magnitude than any meeting in the 18 months of the organization's existence.

The outstanding subjects of discussion will, of course, be the reports of the committees on the voluntary agreement and analysis of the Marshall plan, both of which may be the subject of extended debate and the former, in all likelihood, of some controversy.

Appointment of the 1948 membership of the council was completed last week by Interior Secretary J. A. Krug, with 10 new members in addition to those previously announced.

New men on the council will include Munger T. Ball, president, Sabine Transportation Co., Port Arthur; J. C. Donnell, II, vice president, Ohio Oil Co., Findlay, Ohio; J. B. Fisher, president, Kendall Refining Co., Bradford, Pa.; Don E. Gilman, executive vice president, Western Oil and Gas Association, Los Angeles; B. C. Graves, president, Union Tank Car Co., Chicago; William M. Keck, Jr., president, Consolidated Natural Gas Co., New York; Brown L. Meece, vice president, Globe Oil Refining Co., Chicago; S. F. Niness, president, Lehman Transportation Co., Downingtown, Pa.; Joseph F. White, Boston; and Henry E. Zoller, president, Derby Oil Co., Wichita, Kans.

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